Standard Size, 9 x 12. JUNE 30, 1904 Price Ten Cents.

# AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

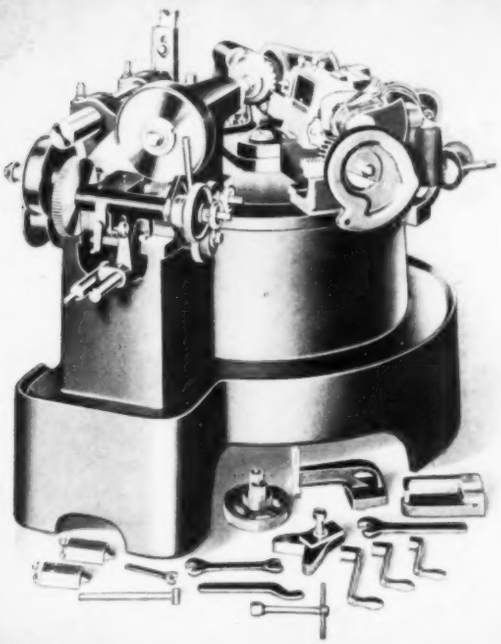
ISSUED WEEKLY BY THE HILL PUBLISHING COMPANY,

Vol. 27. WORLD BUILDING, NEW YORK. No. 26.

Index to Advertisers and Classified Index Following Reading Matter.

GLEASON

BEVEL GEAR PLANER



POINTS of OUR STANDARD DESIGN WITH PLANER TOOL

Planes Teeth to Exact Cone Lines Either from the Solid or from the Rough

Planes Bevels of any Angle 8 or more to 1

Sizes: 24", 36", 48"

POINTS of OUR NEW DESIGN with SHEARING TOOL

Cuts to EXACT Cone Lines from the Solid Only

Gives Perfect Smooth Finish

Planes Bevels from Miters to Ratio of 5 to 1. In Very Fast Time for Gears with this Range

Size: 15"

NEW DESIGN

"SHEARING CUT"

GLEASON WORKS

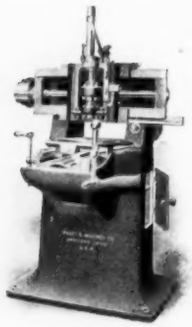
ROCHESTER, N. Y.

AGENTS: BUCK & HICKMAN, LONDON; CHARLES CHURCHILL & CO., LONDON; FENWICK FRERES, PARIS; SCHUCHARDTS, BERLIN.

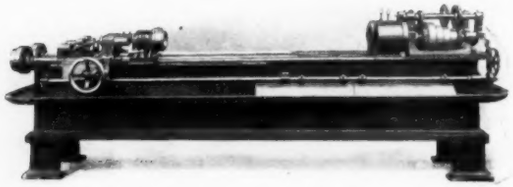
# MILLING MACHINES,

GUN BARREL DRILLING AND RIFLING MACHINES.

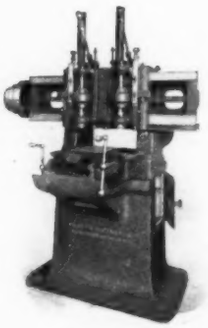
**Visit our exhibit, Block 17, Palace of Machinery, World's Fair, St. Louis.**



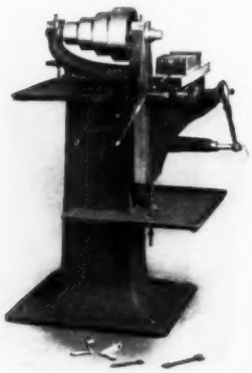
One-Spindle Profiler.



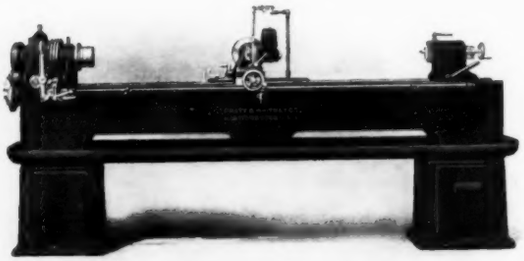
No. 3 Gun Barrel Drilling Machine.



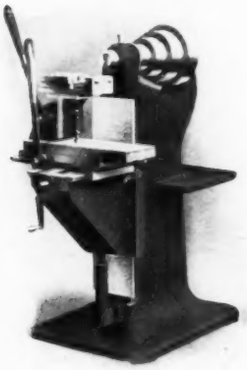
Two-Spindle Profiler.



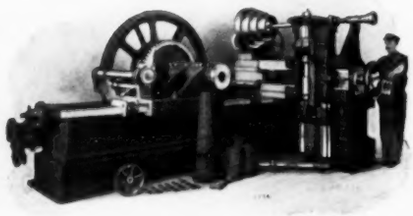
No. 2 Hand Miller.



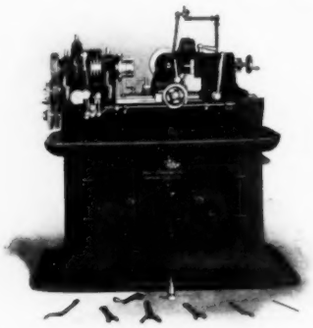
Thread Milling Machine, 6″ Swing, 80″ between centers.



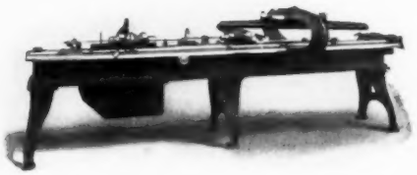
No. 2 Hand Miller with Vertical Vise-Slide.



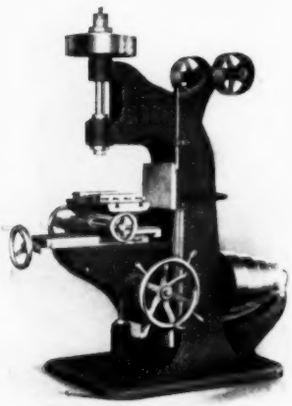
120″ Gear Cutting Machine.



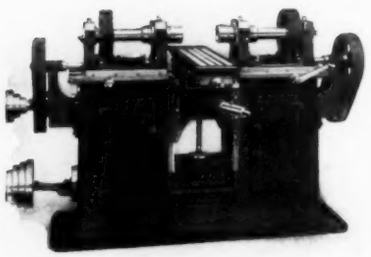
6 x 14″ Thread Miller.



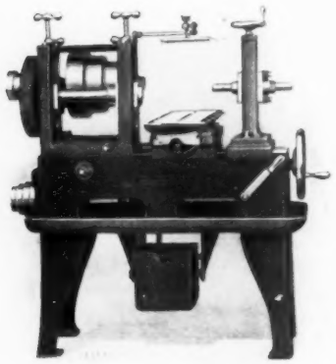
No. 3 Rifling Machine.



No. 2 Die Sinking Machine.



Double Column Milling Machine.

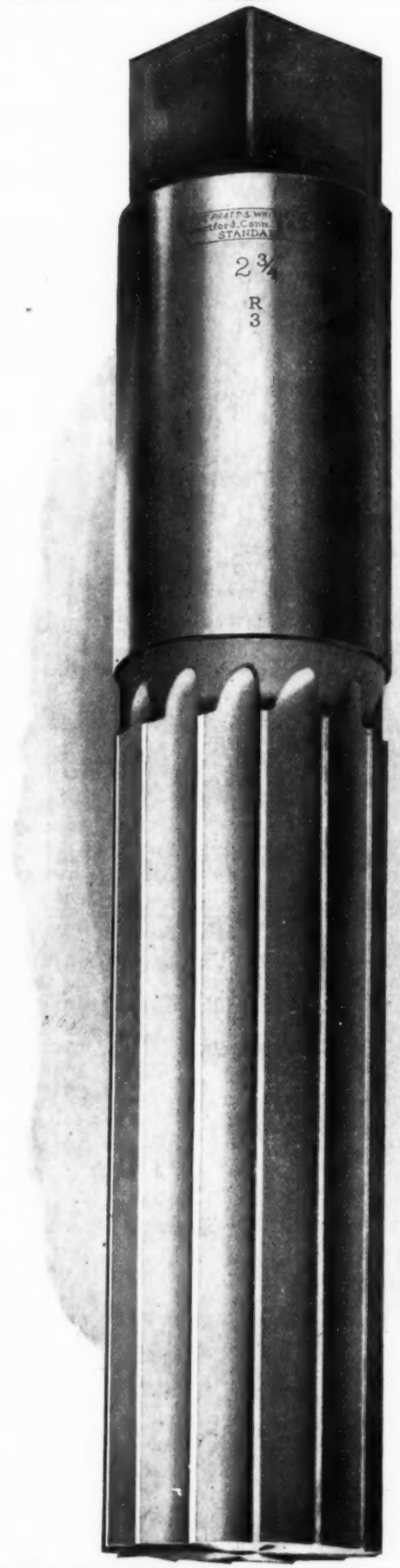


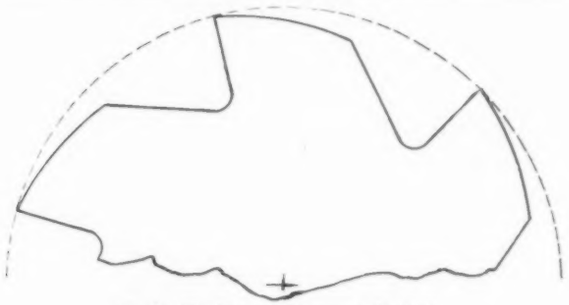
No. 12 Lincoln Milling Machine.

**Pratt & Whitney Co.,** 136-138 Liberty St., New York.
Works: Hartford, Conn., U.S.A.

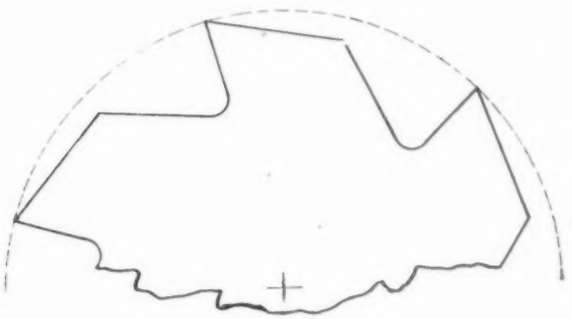
OFFICES:

Boston: 144 Pearl St. Philadelphia: 21st and Callowhill Sts. Pittsburgh: Frick Bldg.
Chicago: 46 South Canal Street. St. Louis: 516 North 3d St. AGENTS: The Fairbanks Co., 749 Craig St., Montreal, P. Q.



P. & W. Patent Eccentric Relief.



Flat Relief.

# ECCENTRIC RELIEF REAMERS.

Eccentric ground reamers give a smooth glass surface, and will not chatter, because the cutting edge is supported. Our Small Tool Catalog covers

**Taps, Dies, Ratchet Drills, Boiler Punches, Milling Cutters, Lathe Tools, Taper Pins, Gauges, Etc.**

## PRATT & WHITNEY CO.

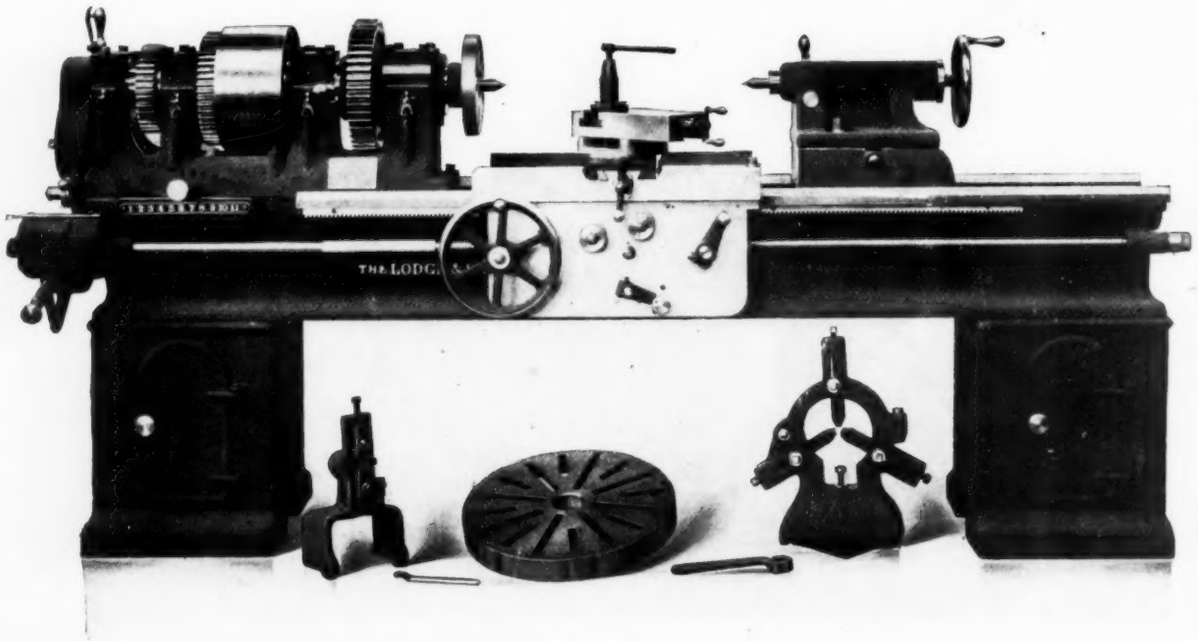
136-138 LIBERTY ST., NEW YORK.

WORKS: HARTFORD, CONN., U.S.A.

—OFFICES—

Boston—144 Pearl Street. Philadelphia—21st and Callowhill Streets.
Pittsburgh—Frick Building. Chicago—46 South Canal Street.
St. Louis—516 North 3d Street.
AGENTS—The Fairbanks Co., 749 Craig Street, Montreal, P. Q.

**Visit Our Exhibit,** Block 17, Palace of Machinery, World's Fair, St. Louis.



# L. & S. PATENT HEAD LATHE

## 18 Forward Speeds

— or —

## 9 Forward and 9 Backing Speeds

| | | | | | |
|---|---|---|---|---|---|
| 14 | inch; | width of belt, | 3½ | inches. |
| 16 | " | " | " | 4 | " |
| 18 | " | " | " | 4½ | " |
| 20 | " | " | " | 5 | " |
| 22 | " | " | " | 6 | " |
| 24 | " | " | " | 6½ | " |
| 27 | " | " | " | 7 | " |
| 30 and 36 | " | " | " | 8 | " |
| 42 and 48 | " | " | " | 9 | " |

**Positive Lubricating Device on Spindle and Back-Gear Shaft.**

---

## The Lodge & Shipley Machine Tool Co.,

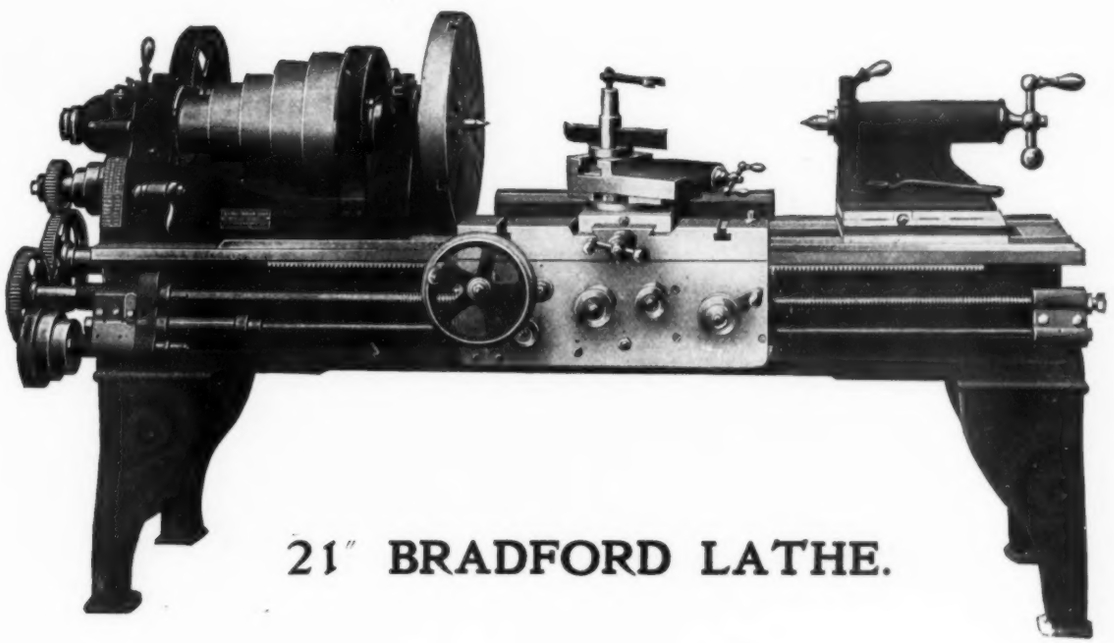
### Cincinnati, Ohio, U.S.A.

CANADIAN AGENTS—Williams & Wilson, Montreal. H. W. Petrie, Toronto.
EUROPEAN AGENTS—C. W. Burton, Griffiths & Co., London. Fenwick Freres, Paris. V. Lowener, Copenhagen. R. S. Stokvis & Zonen, Rotterdam. Adler & Eisenschitz, Milan.

# CONICAL SPINDLE BEARINGS

IN THE

# BRADFORD LATHE



21″ BRADFORD LATHE.

Are made from the best composition Phosphor Bronze, and keyed to the Headstock. They are adjustable by means of the threaded collars, making a safe, economical and accurate bearing, easy of adjustment. The Oil Grooves in these bearings are cut on our Coarse Screw Cutting Lathe, and not chipped in.

Our Book, "*Bradford Lathes*," describes these tools in detail. *Sizes, 14 to 42-inch Swing. Ask for a copy.*

THE

## BRADFORD MACHINE TOOL CO.,

CINCINNATI, O., U.S.A.

AGENTS—The J. R. Vandyck Co., New York and Philadelphia, Eastern Agents. Pacific Tool & Supply Co., San Francisco, Cal., Agents for Pacific Coast. Foreign Agents—Chas Churchill & Co., Ltd., London, Birmingham, Manchester, Glasgow, Newcastle-on-Tyne. Schuchardt & Schutte, Berlin, Cologne, Vienna, St. Petersburg, Brussels, Stockholm, Paris, Milano, Bilbao.

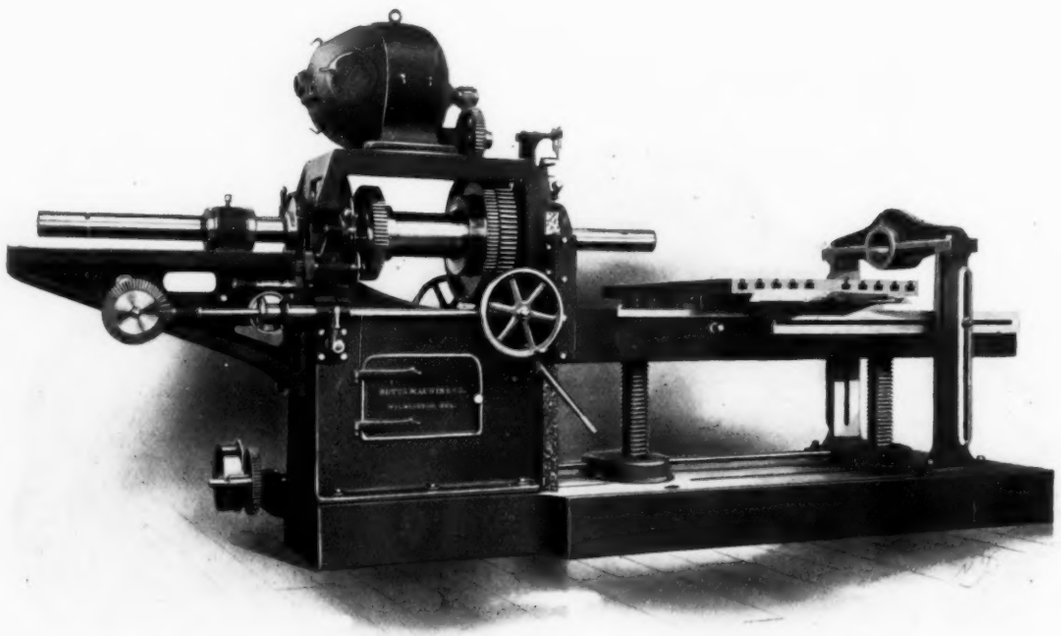
# BETTS MACHINE COMPANY,

## WILMINGTON, DEL., U.S.A.

MAKERS OF

# Heavy Machine Tools

## Of the MOST ADVANCED TYPES.



**MOTOR-DRIVEN No. 3 HORIZONTAL BORING AND DRILLING MACHINE.**
**Spindle diameter 5 in. Length of Table 10 ft. Extreme swing 83 in.**

As shown at the Louisiana Purchase Exposition,
St. Louis, Mo., Block 9, Palace of Machinery.

---

**Horizontal Boring and Drilling Machines,** usual sizes.

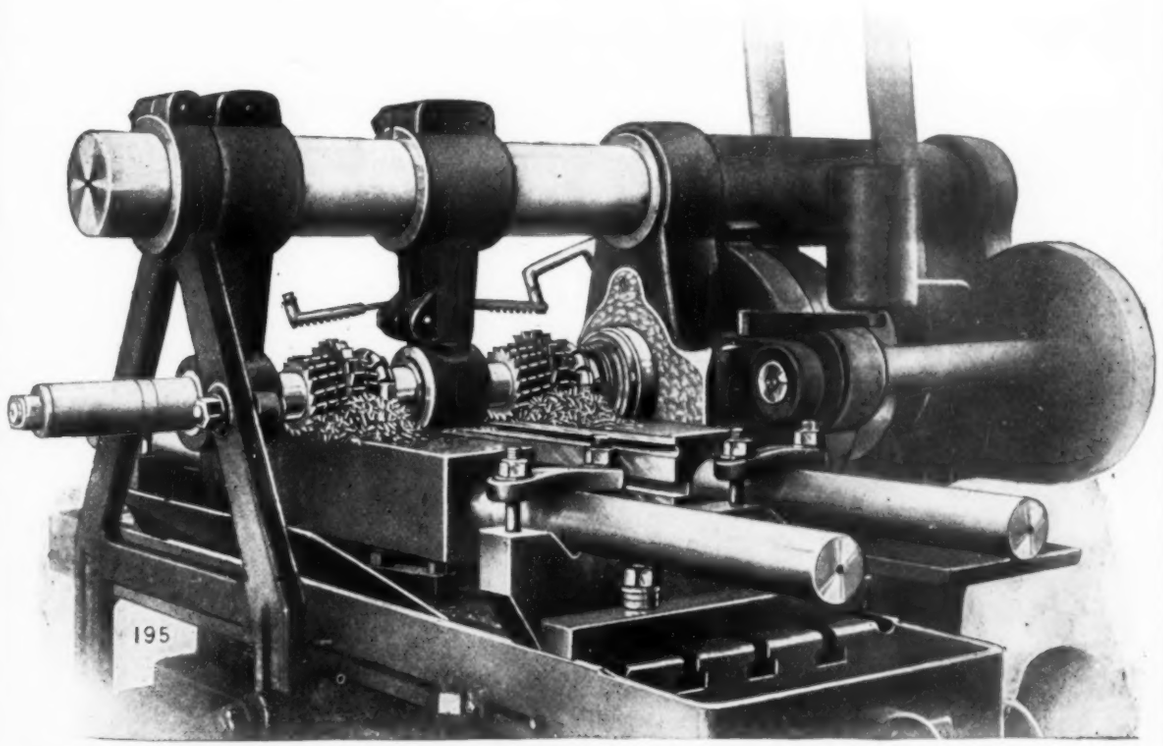
**Vertical Boring and Turning Mills,**
from 5 ft. to 20 ft. swing.

**Planing Machines,** from 3 ft. sq. to 10 ft. sq.

**Slotting Machines,** from 8 in. to 24 in. stroke.

# 50 Point Carbon 4½ in. Square Steel Bars.

These are finished to 4" square, the cut is ¼" deep, and each has one groove 21/32" wide x ⅞" deep, and another ¾" wide x ¼" deep.
The illustration shows how the J. A. Fay & Egan Company, Cincinnati, finish two of these at a single cut on a




# No. 4 Plain Cincinnati Geared Feed Miller

at a table travel of 15/16" per minute. The cutters are 4" and 5¾" diameter, Novo steel, working at 30' surface speed. The job goes through smoothly without the slightest chatter.
Everybody will admit that that's pretty fast milling for a No. 4 Machine, and that none but a "Cincinnati" can do it, but the point is, *how fast are you doing similar work?* Look up your time cards, and then let us estimate on your milling.

**Ask for our "Examples of Rapid Milling."**

**Louisiana Purchase Exposition.**—**Our electrically-driven Millers may be seen in Palace of Electricity in the exhibits of the Westinghouse Electric & Mfg. Co., Northern Electrical Mfg Co., Western Electric Co.**

**WE ARE MILLING SPECIALISTS.**

## The Cincinnati Milling Machine Co.

**Cincinnati, Ohio, U.S.A.**

EUROPEAN AGENTS—Schuchardt & Schutte, Berlin, Cologne, Vienna, St. Petersburg, Brussels, Stockholm, Liege, Milan, Paris, Bilbao. Chas. Churchill & Co., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow. Niles-Bement-Pond Co., 23 and 25 Victoria St., London, S. W.
CANADIAN AGENTS—Williams and Wilson, Montreal. H. W. Petrie, Toronto.

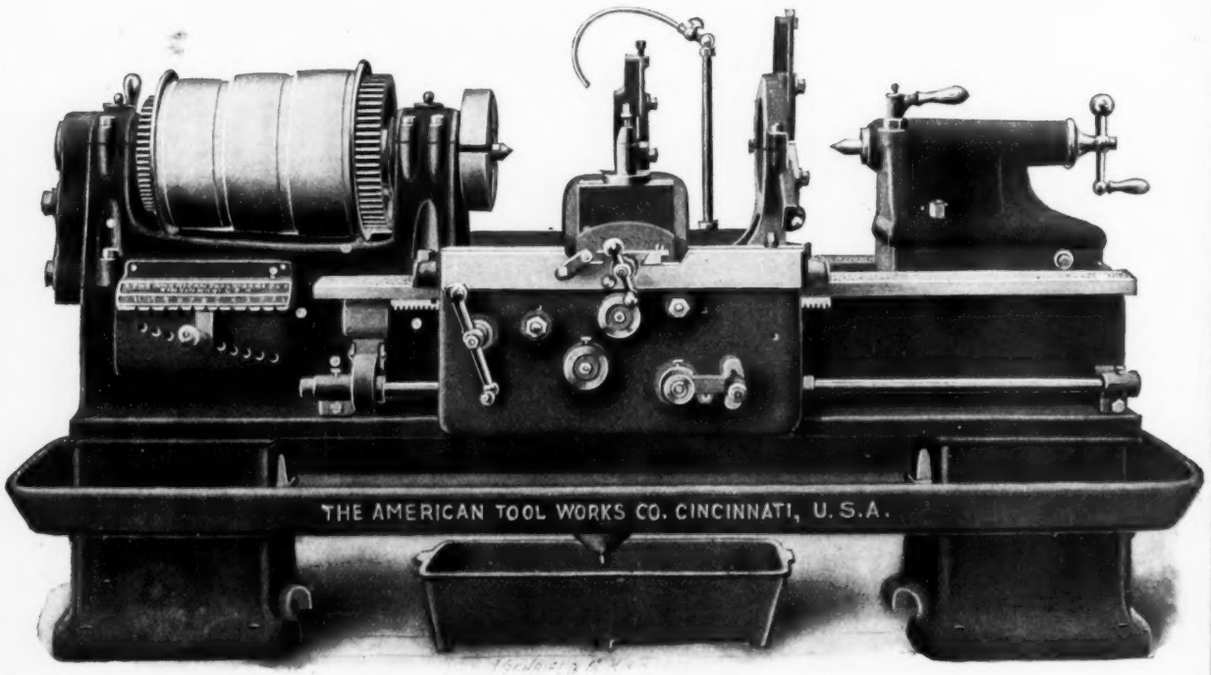
# THE AMERICAN TOOL WORKS CO.,

**CINCINNATI, U.S.A.**

Designers and builders of highly improved metal working machinery, for rapid work production by progressive methods:

## LATHES—PLANERS—SHAPERS—DRILLS.

We equip any of our machine tools with **Improved Motor Drive.**




## THE NEW "AMERICAN" HIGH SPEED MANUFACTURING LATHE.

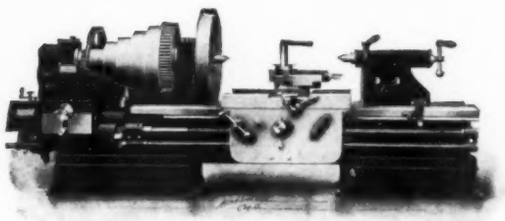
The greatest of all the "high speed lathes" in its efficiency under continuous hard service at extremely high speeds.

**We have proofs** in the words of our customers. This wonderful machine is working revolutions in shop methods wherever installed.

If you are interested in the rapid turning of shafts from 1″ to 4″ diameters, send for detailed information on this truly remarkable tool.

# SCHUMACHER & BOYE 32" PATENTED INSTANTANEOUS CHANGE GEAR ENGINE LATHE.

**Any Pitch or Feed instantly obtainable, without removing a Gear, as shown in the Index:**



| TOP INDEX HANDLE IN HOLE | CUTS | FRONT INDEX HANDLE IN HOLE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | Threads per Inch | 1 | 1 1/8 | 1 1/4 | 1 3/8 | 1 7/16 | 1 1/2 | 1 5/8 | 1 3/4 |
| 2 | " " " | 2 | 2 1/4 | 2 1/2 | 2 3/4 | 2 7/8 | 3 | 3 1/4 | 3 1/2 |
| 3 | " " " | 4 | 4 1/2 | 5 | 5 1/2 | 5 3/4 | 6 | 6 1/2 | 7 |
| 4 | " " " | 8 | 9 | 10 | 11 | 11 1/2 | 12 | 13 | 14 |

Feeds 5 Times Threads per Inch.
W. T. Emmes Patent, August 26, 1902, October 28, 1902.

**SCHUMACHER & BOYE, ENGINE LATHES, 18" to 48" Swing, CINCINNATI, OHIO, U.S.A.**

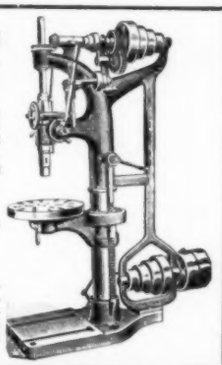
Foreign protective tariffs do not keep Bertram machine tools out of foreign shops.

Write for photographs

**The John Bertram & Sons Co., Ltd.**
Dundas, Ontario, Canada

## We Make Drills From 10 to 32"

and also Gang Drills. Our Catalog, which will be of interest to you, sent free upon application. We also make the best Power Metal Saw.



**HOEFER MFG. CO.,**
250 Liberty Street,
Freeport, Ill.

AGENTS—C. W. Burton, Griffiths & Co., London, Eng. Schuchardt & Schutte, Berlin, Cologne, Vienna, Brussels and Stockholm. J. Lambercier & C°, Geneva, Switzerland.

## THE HIGLEY COLD SAW

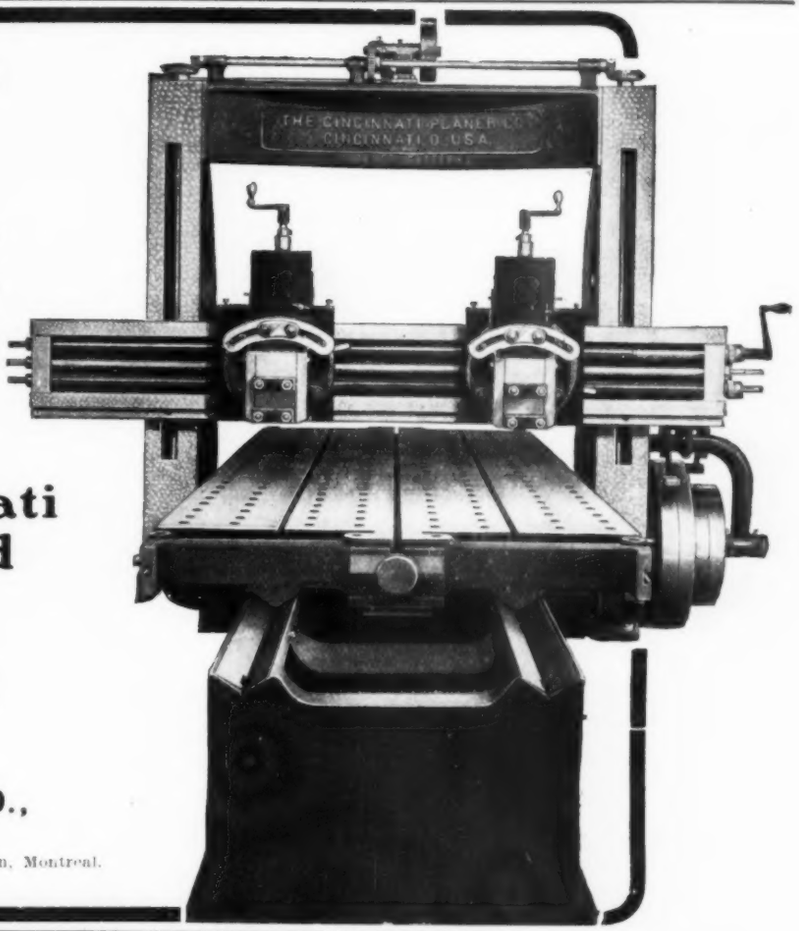
**THE J. R. VANDYCK CO.**
8 Day Street, New York.
The Bourse, Philadelphia.

# If You Are Not Satisfied With One Speed

you should investigate the Cincinnati Variable Speed Planers.
2, 4, or 6 Cutting Speeds are possible on these planers, ranging from 15 to 80 feet per minute, with a uniform return speed and changes are made instantly while machine is running.
If you want a planer suited to all materials and conditions,

# Get A Cincinnati Variable Speed Planer.

Made in sizes from 24" to 84" and equipped with belt or motor drive as desired.
Send for Catalog.




**THE CINCINNATI PLANER CO.,**
**Cincinnati, Ohio, U.S.A.**

H. W. Petrie, Toronto, Canada. Williams & Wilson, Montreal.
R. S. Stokvis & Zonen, Rotterdam, Holland.

**As Rigid as a Solid Reamer.**
Particulars on request.

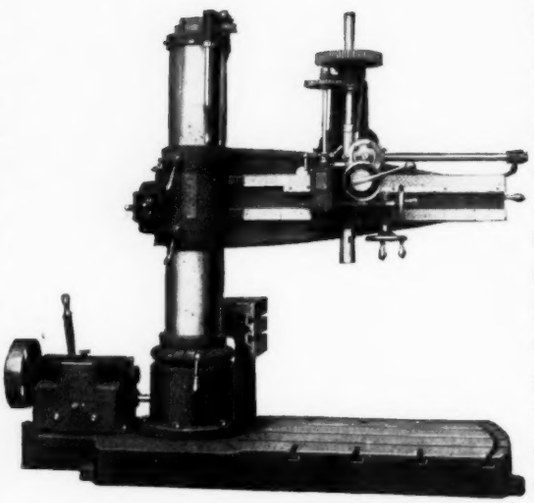
The "Lapointe" Solid Shank Adjustable Reamer, made with tapering body, allowing for chip clearance.

**Lapointe Machine Tool Co., 30 Atlantic Ave., Lewis Wharf, Boston, Mass., U S A.**

# — POWER —

in the New Bickford Radial is transmitted economically, the maximum power at the spindle being obtained with comparatively low tension in the driving belt, due to the high ratio of the transmission gears.

The pull that a Radial Drill is capable of furnishing at the spindle depends largely upon three things: tension in driving belt, speed of driving belt, and ratio between pulley and spindle. Other things being equal, therefore, the most powerful machine is that which has the largest ratio between pulley and spindle. In our machines this ratio increases with the size of the tool, but in no case do we make it less than 13.91—which is more than double that used on many radials.



**CORROBORATIVE DETAIL**

Being extracts from our folder

**BOUQUETS,**

Which folder may be had for the asking.

---

Baltimore, Md.

We beg to say that we have two of your #1 Drills and that we consider them the best drills on the market. Roughly speaking, they have increased our output about 50%. THEY CONSUME LITTLE POWER, do their work accurately and up to the present time we have not spent a cent in repairs on them.

When we need more drills of this type we will certainly buy the Bickford.

Very truly yours,

H. MILLER SAFE & IRON WORKS.

per Anthony Kennedy

---

**THE BICKFORD DRILL & TOOL COMPANY,**

**CINCINNATI, O., U. S. A.**

FOREIGN AGENTS—Schuchardt & Schutte, Berlin, Vienna, Cologne, St. Petersburg, Brussels, Stockholm, Paris, Liege, Milan, Bilbao and New York. Charles Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow. F. W. Horne, Yokohama, Japan. H. W. Petrie, Toronto, Canada. Williams & Wilson, Montreal, Canada.

89A

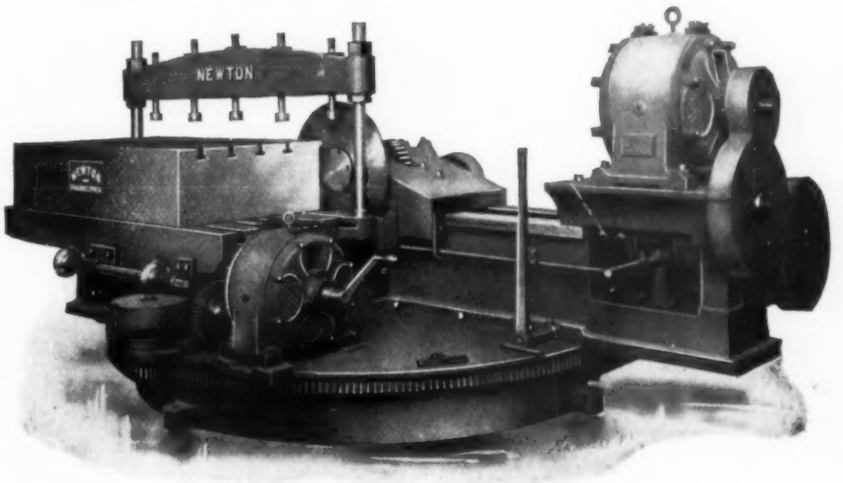
Milling Machines

Boring Machines

Rotary
Planing Machines

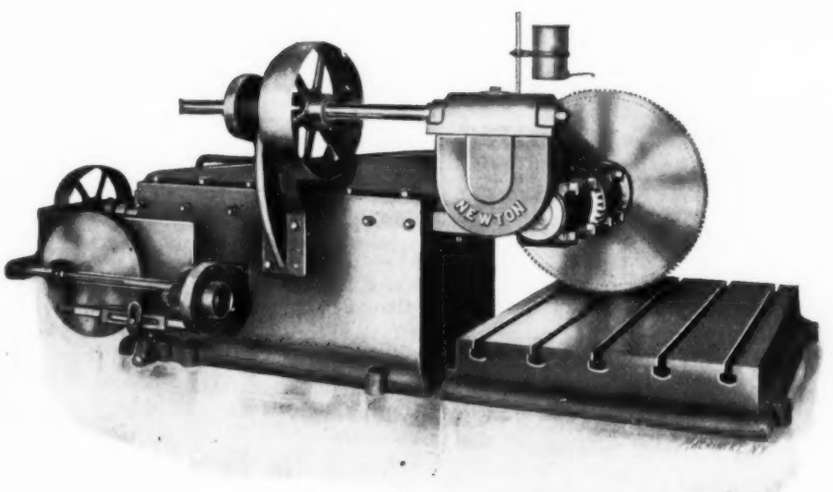
Slotting Machines

Drilling Machines




COMBINATION COLD SAW CUTTING-OFF MACHINE
MOUNTED ON ROUND BASE FOR BRIDGE OR STRUCTURAL WORK

# NEWTON



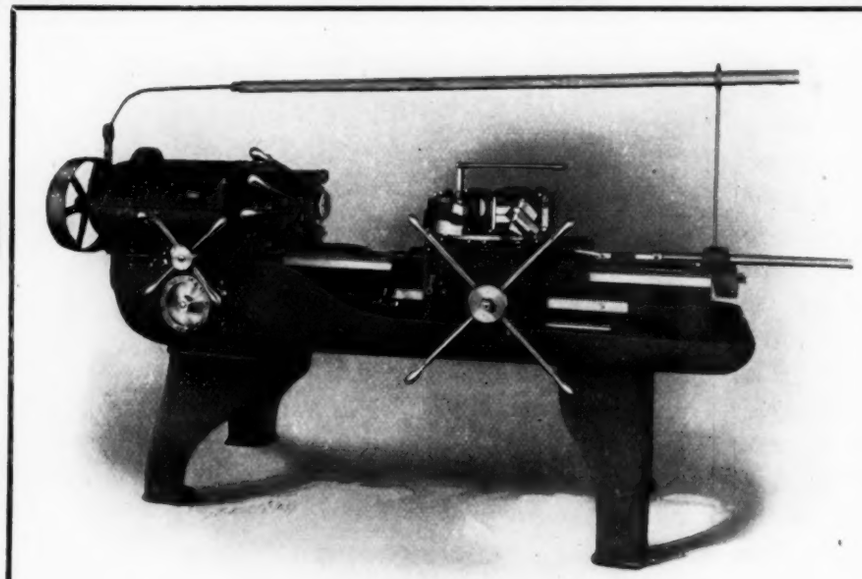

No. 1 STEEL FOUNDRY COLD SAW CUTTING-OFF MACHINE

Special Machines

Locomotive and Railway Shop Equipment

Portable Machines

**Newton Machine Tool Works, Inc.**
**Philadelphia, U.S.A.**



The "Flat Turret"

## The "Flat Turret Lathe" With Cross-Feeding Head

is a creation of the makers of the popular and well-known and well-liked "Flat Turret" Lathe. The many excellent features of the old "Flat Turret" have been kept and other features added so that this machine stands far above all other machines for duplicate work production. It has a much greater range for work than the older Flat Turret and comes to you accompanied with an iron-clad guarantee as to performance. The "Flat Turret" Lathe in your shop means a saving in the production of duplicate work of from 50% to 80%, and if such a saving interests you we shall be pleased to send full details.

# Jones & Lamson Machine Com'y

Springfield, Vt., U.S.A., and 97 Queen Victoria St, London, E.C.

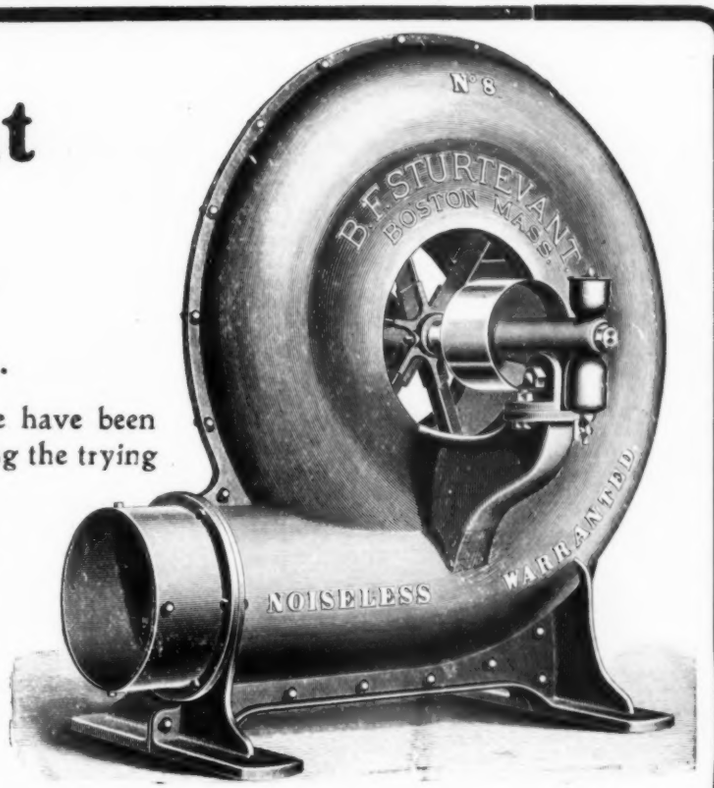
Germany, Holland, Belgium, Switzerland and Austria-Hungary: M. Koyemann, Charlottenstrasse, 112, Dusseldorf, Germany.
France and Spain: Ph. Bonvillain, 6, Rue Blanche, 6, Paris, France. Italy: Adler & Eisenschitz, Milan.

IF IT'S A

# Sturtevant Blower

IT'S THE BEST

**That good Materials and Workmanship can produce.**




**FOR OVER 40 YEARS** we have been perfecting these Blowers, studying the trying conditions under which they must operate, making them stiff enough to stand any strain, providing journal bearings so large and oiling arrangements so reliable that they will last a lifetime.

In a word, we have made them PERFECT.

**B. F. STURTEVANT CO., Hyde Park, Mass.**

**Boston. New York. Philadelphia. Chicago. London.** 198

# Advantages

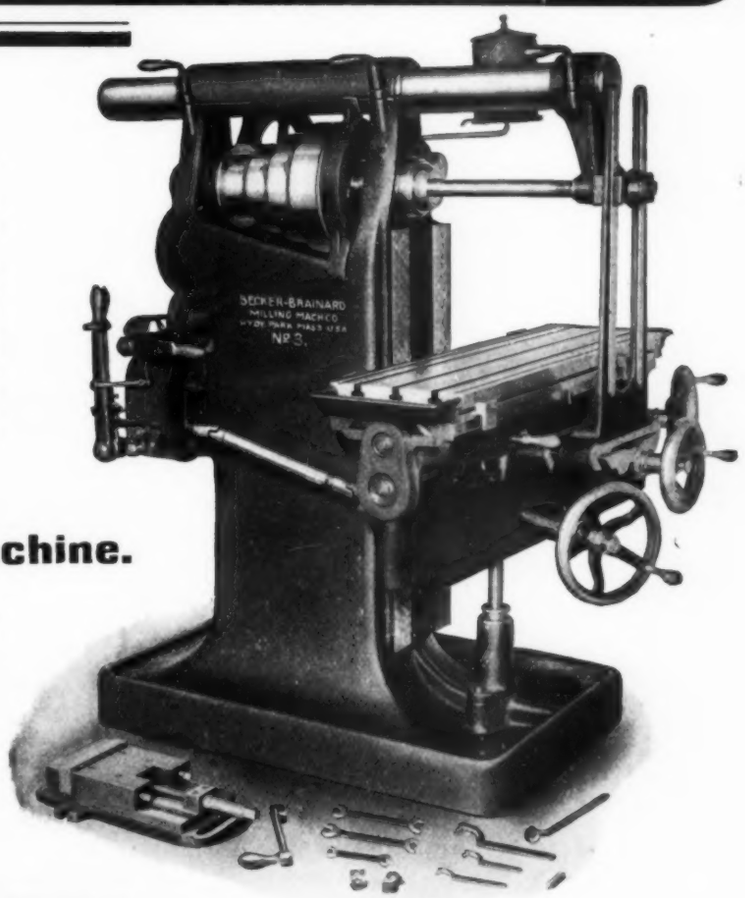
are sure to be found with such special features as:—

The unusually long carriage which furnishes support for the table its entire length of feed.

The extra length of bearing of knee on column, which permits an unusual range of cross-feed. Heavy construction of column and base, which absorbs vibration when taking heavy cuts. Hand wheels provided with clutch mechanism for locking and releasing. Quick change feed mechanism giving twenty changes of feed without stopping the machine and others embodied in

## Our No. 3 Gear Feed Plain Milling Machine.

Of course all the standard features are in this machine, so that the addition of these special advantages make it decidedly a leader. Send for catalogue.




**Becker-Brainard Milling Machine Co.,**
**Hyde Park, Mass.**

210

# THE "ORIGINAL BARNES"

**8-inch to 50-inch Swing**

## POSITIVE FEED DRILLS

**CONSIDER THESE ADVANTAGES:**

1st. Absolutely positive action.
2d. Eight (8) changes of feed.
3d. No belts to throw off and on.
4th. Feed changes can be made while machine is running.
5th. Capacity of drill increased 15 to 25 per cent.
6th. Adapted for use of high-speed cutting steels.

## POSITIVE FEED

can be seen at the following places; some one of these agents is only a short distance from your factory and we do hope you will call and see the Positive Feed which is the greatest improvement ever placed on a drilling machine.

World's Fair, - - Electrical Building, Sec. 14, Dept. F.
Baltimore, Md., - - Carey Machinery and Supply Co.
Boston, Mass., - - Chandler & Farquhar Co.
Buffalo, N. Y., - - Fairbanks Co.
Chicago, Ill., - - Manning, Maxwell & Moore.
Cincinnati, Ohio, - E. A. Kinsey Co.
Cleveland, Ohio, - W. M. Pattison Machinery Co.
Dayton, Ohio, - - Patterson Tool and Supply Co.
Denver, Col., - - Hendrie & Bolthoff Mfg. and Supply Co.
Detroit, Mich., - - C. C. Wormer Machinery Co.
Indianapolis, Ind., - Vonnegut Hardware Co.
Kansas City, Mo., - English Iron Works Co.
Los Angeles, Cal., - Harper & Reynolds Co.
Minneapolis, Minn., - Northern Machinery Co.
Montreal, Quebec, - Williams & Wilson.
New Orleans, La., - McArdle-Parker Machinery Co.
New York City, - - Manning, Maxwell & Moore.
Philadelphia, Pa., - Manning, Maxwell & Moore.
Rochester, N. Y., - Belting and Machinery Co.
St. Louis, Mo., - - Wm. C. Johnson & Sons Machinery Co.
St. Paul, Minn., - - Robinson & Cary Co.
Salt Lake City, Utah, Salt Lake Hardware Co.
San Francisco, Cal., Henshaw, Bulkley & Co.
Seattle, Wash., - - Hallidie-Henshaw-Bulkley Co.,
Syracuse, N. Y., - Syracuse Supply Co., Ltd.
Toledo, Ohio, - - National Supply Co.
Toronto, Ont., - - A. R. Williams Machinery.

*SEND FOR DRILL CATALOGUE*

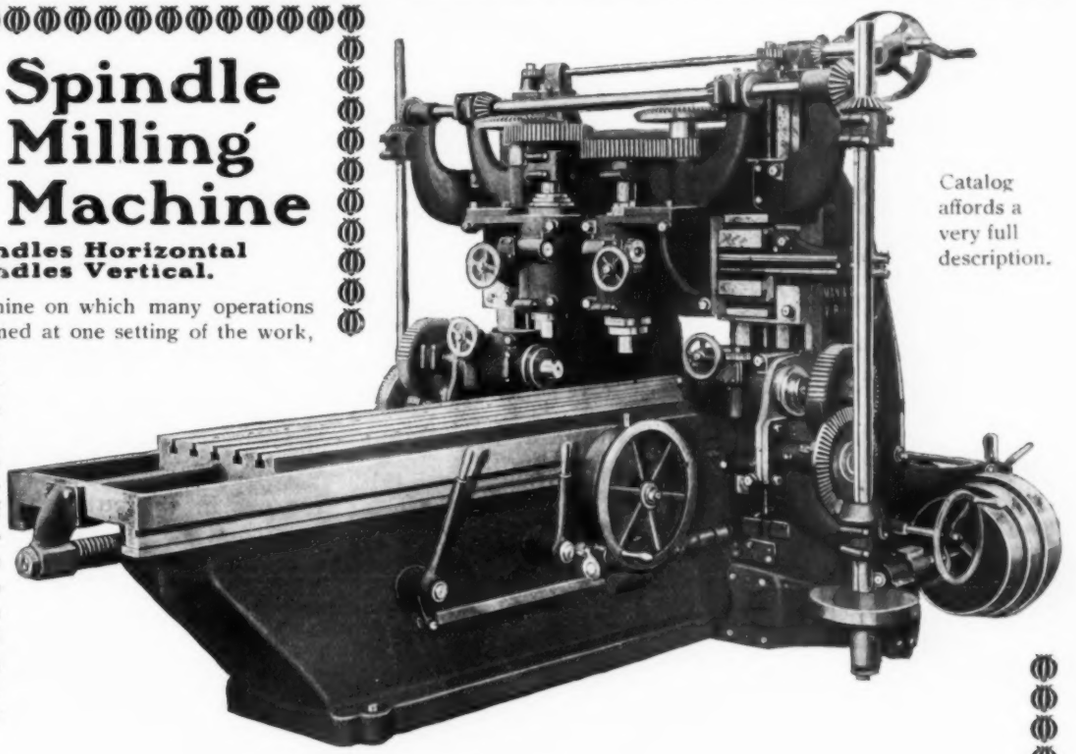
# W. F. & John Barnes Co.,

**1995 Ruby St., Rockford, Illinois.**

# 4 Spindle Milling Machine

**2 Spindles Horizontal**
**2 Spindles Vertical.**

A Milling Machine on which many operations may be performed at one setting of the work, saving much time and insuring the extreme for accuracy. Capacity is as follows: between ends of horizontal spindles 19½" to 25½", center to top of table o to 15", from end of vertical to top of table o to 18", center to center 9½" to 26".



Catalog affords a very full description.

**The Beaman & Smith Co., Providence, R. I.**

Chas. Churchill & Co., London. Fenwick Freres & Co., Paris.

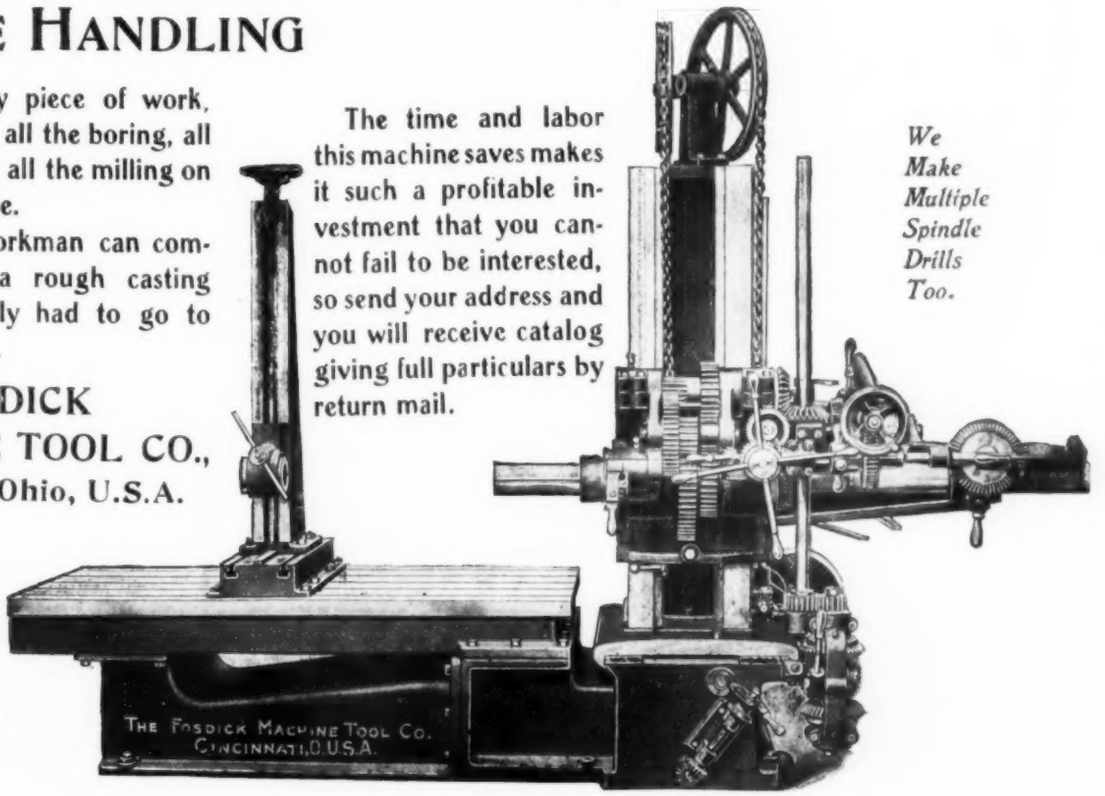
# OUR NEW HORIZONTAL BORING, DRILLING AND MILLING MACHINE SAVES 66% OF THE HANDLING

of nearly every piece of work, because it does all the boring, all the drilling and all the milling on the one machine.

With it a workman can completely finish a rough casting which previously had to go to three machines.

The time and labor this machine saves makes it such a profitable investment that you cannot fail to be interested, so send your address and you will receive catalog giving full particulars by return mail.

*We Make Multiple Spindle Drills Too.*



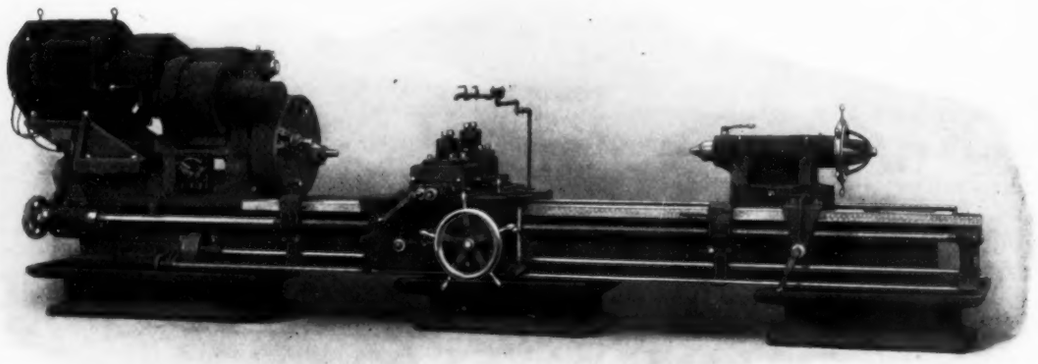

THE FOSDICK MACHINE TOOL CO.,
Cincinnati, Ohio, U.S.A.

Manufacturers of Radial Drills, Plain and Universal, with 2½' to 8' arms, and Horizontal Boring, Drilling and Milling Machines.

# 6 Tons Per Day

or 1,200 to 1,300 lbs. of cast iron, and 900 to 1,000 lbs. of machine steel, is the amount of metal a Bullard "Rapid Production" Lathe will remove in one hour.

This is not the result of a test for one day only, but what this machine is capable of every day. It takes more than an ordinary lathe to stand up to such work.



## BULLARD 26″ RAPID PRODUCTION LATHES

were designed expressly for high speed turning and are exceptionally powerful, rigid and heavy. They are built with 14, 16, 18, 20, 24, 30 and 32-foot beds.

You could do your lathe work in 300 to 500 per cent. less time on a Bullard. Send us blue prints and we will submit estimates.

*To what address shall we send Circular A-26?*

**Box 1050,**
**Bridgeport, Conn., U. S. A.**

**The Bullard Machine Tool Co.**

AGENTS—Marshall & Huschart Machinery Co., Chicago, Cleveland. The C. H. Wood Co., Syracuse, N. Y. Harron, Rickard & McCone, San Francisco, Cal. Chas. G. Smith Co., Pittsburg, Pa. The Milner & Kettig Co., Birmingham, Ala. Williams & Wilson, Montreal, P. Q. Chas. Churchill & Co., Ltd., London, E. C., England. Schuchardt & Schutte, Berlin, Cologne, Vienna, Brussels, Stockholm, St. Petersburg, Paris.

No. 131A
Stocking Cutters
for Involute Gears

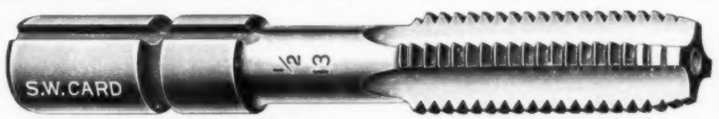
# Morse Cutters

are made of first class steel and great care is given to each and every process to insure a good tool and perfect satisfaction to the user.

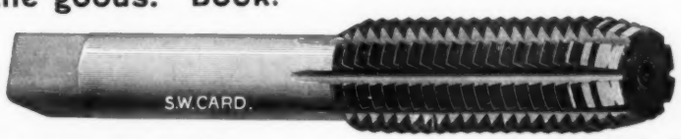
Our 1904 catalogue describes many kinds and sizes. Have you a copy? If you are interested in our manufactures send for one. It will cost you only a postal card.

We like to call your attention to pages 220-224 inclusive of our new catalogue and after reading send us your order for Involute Cutters.

**Morse Twist Drill and Machine Company,**
New Bedford, Mass., U.S.A.




**Card says his Taps are good—good as money can buy—and he backs the talk with the goods. Book.**




**S. W. CARD MFG. CO.,** Mansfield, Mass.
Chas. Churchill & Co., London, Birmingham, Manchester and Glasgow.

**A Whistle Needn't Shriek**

In order to be heard. We make the original

**Single-Bell Chime Whistle.**

It can be heard much farther than the old fashioned kind, but yet is very agreeable to the ear. Especially suited to machine shops. Let us send you the details.

**Crosby Steam Gage & Valve Co.**
**Office & Works, Boston, Mass.**

95-97 Oliver Street, Boston, Mass. 78 John Street, New York.
21 and 23 W. Lake St., Chicago. 147 Queen Victoria St., London.

# EVERY NICHOLSON FILE

is made of especially selected steel. Forged by expert workmen. Cut by special patented machinery. Tempered in the Nicholson way, which gives it a uniform temper that has the greatest resistance to wear. Thoroughly tested for shape, cutting qualities, soundness and temper. Branded upon the tang with the name NICHOLSON FILE CO., which guarantees it to be right, and wrapped in special anti-rust paper.

3,000 different styles and sizes.

Ask for "File Filosofy," a practical and interesting book for file users. Free.

**NICHOLSON FILE COMPANY,**
**PROVIDENCE, R. I., U.S.A.**

# Bevel Gears

are cut by me theoretically correct, and so are adapted to fine machinery of all kinds. I have special facilities for cutting SPUR, WORM, SPIRAL, MITRE and INTERNAL wheels.

Let me quote on your specifications.

**Special Machines for Cutting Bevel Gearing.**

**Hugo Bilgram, Machinist,** 1233 Spring Garden Street, PHILADELPHIA, PA.

---

*William Sellers & Co. Incorp.* *Philadelphia, Pa.*

**MODERN MACHINE TOOLS.**

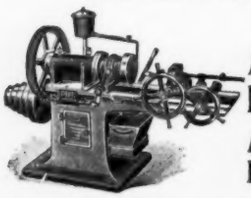
Planers, Slotters, Shapers, Boring and Turning Mills, Lathes, Drills, Boring Machines, Steam Hammers, Riveters, Punches, Shears, Bending Rolls, Tool and Drill Grinders, Sand Mixers, etc., etc.

**CRANES. SHAFTING. INJECTORS. TURNTABLES.**

---

**THE ACME MACHINERY CO.,**

**CLEVELAND, OHIO.**



Manufacturers of

**Acme Bolt and Rivet Headers,**

**Acme Single, Double and Triple**

**Automatic Bolt Cutters.** Cutting from 1 8 in. to 6 in. diameter

**Also Separate Heads and Dies.**

---

**CONTRACT MACHINE WORK**

PROMPT ACCURATE

**The Blanchard Machine Co.**

BOSTON MASS.

---

**THE BALL BEARING COMPANY,**

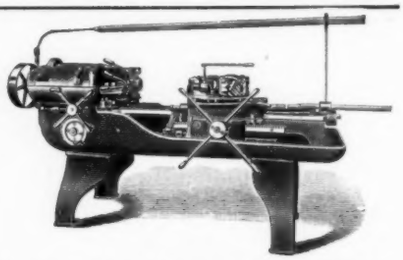
(Formerly of Boston),

Merion & Girard Aves, PHILADELPHIA, PA.

MANUFACTURERS OF

**ANTI-FRICTION BEARINGS.**

---



**THE FLAT TURRET LATHE.**

Does Lathe work accurately up to 2 in. diameter by 24 in. long.

**JONES & LAMSON MACHINE CO.**

**Main Office and Works:**

**SPRINGFIELD, VERMONT, U.S.A.**

*A B C and Lieber's Codes used.*

---

**See Our Advertisement on Page 12.**

---

SHULTZ PATENT SABLE RAWHIDE BELTING.
SHULTZ BELTING Co.
SHULTZ PATENT WOVEN LEATHER LINK BELTING
GENUINE RAWHIDE LACE LEATHER.
SHULTZ'S PATENT PULLEY COVER.
BELT DRESSING AND BELT CEMENT.
DYNAMO BELTING.

*Export Trade a Specialty.* ST LOUIS, MO., U.S.A

---

**Horizontal Boring Machines and Cylinder Boring.**

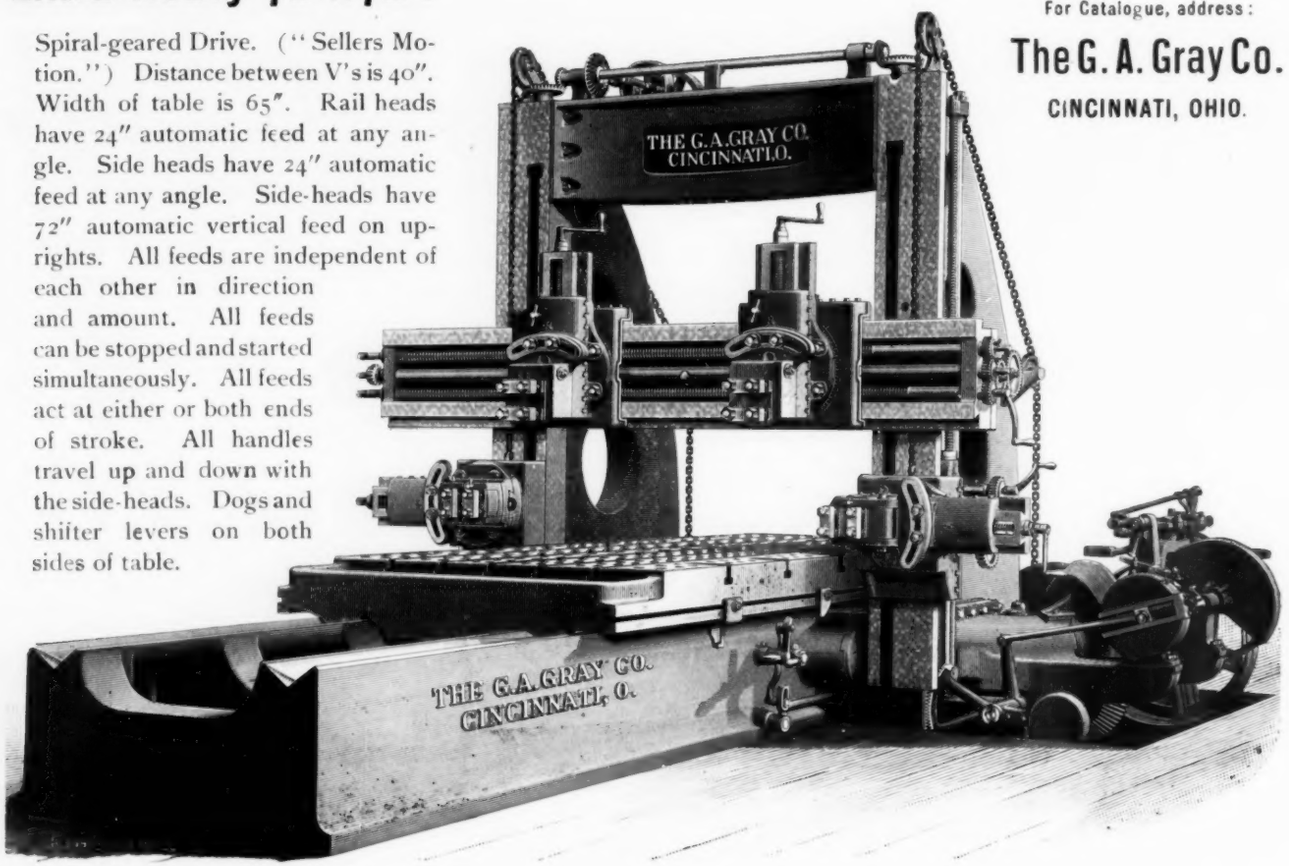
**The Binsse Machine Co.**

**NEWARK, N. J.**

---

## Extra Heavy 72"x72".

Spiral-geared Drive. ("Sellers Motion.") Distance between V's is 40". Width of table is 65". Rail heads have 24" automatic feed at any angle. Side heads have 24" automatic feed at any angle. Side-heads have 72" automatic vertical feed on uprights. All feeds are independent of each other in direction and amount. All feeds can be stopped and started simultaneously. All feeds act at either or both ends of stroke. All handles travel up and down with the side-heads. Dogs and shifter levers on both sides of table.




For Catalogue, address:

**The G. A. Gray Co.**

**CINCINNATI, OHIO.**

## The Flat Turret Lathe with Cross Feeding Head.

EDITORIAL CORRESPONDENCE.

The Jones & Lamson flat turret lathe with cross-feeding head was illustrated in these columns at page 585; at the same time were presented a number of illustrations showing the facility with which the machine, when equipped with a few tools of the simplest character, performs turning, boring, facing and similar operations on gray iron and other chucking work within its capacity.

As stated in a recent article on the Jones & Lamson shops, I had the privilege, while visiting their works, of seeing this interesting machine (which handles bar stock or chucked work with equal facility) in various stages of construction and also of watching it in operation; and it is purposed in the present article to show something of the ingenious mechanism by which the spindle and chuck are driven, the head and carriage fed, and the unique movements in general made possible.

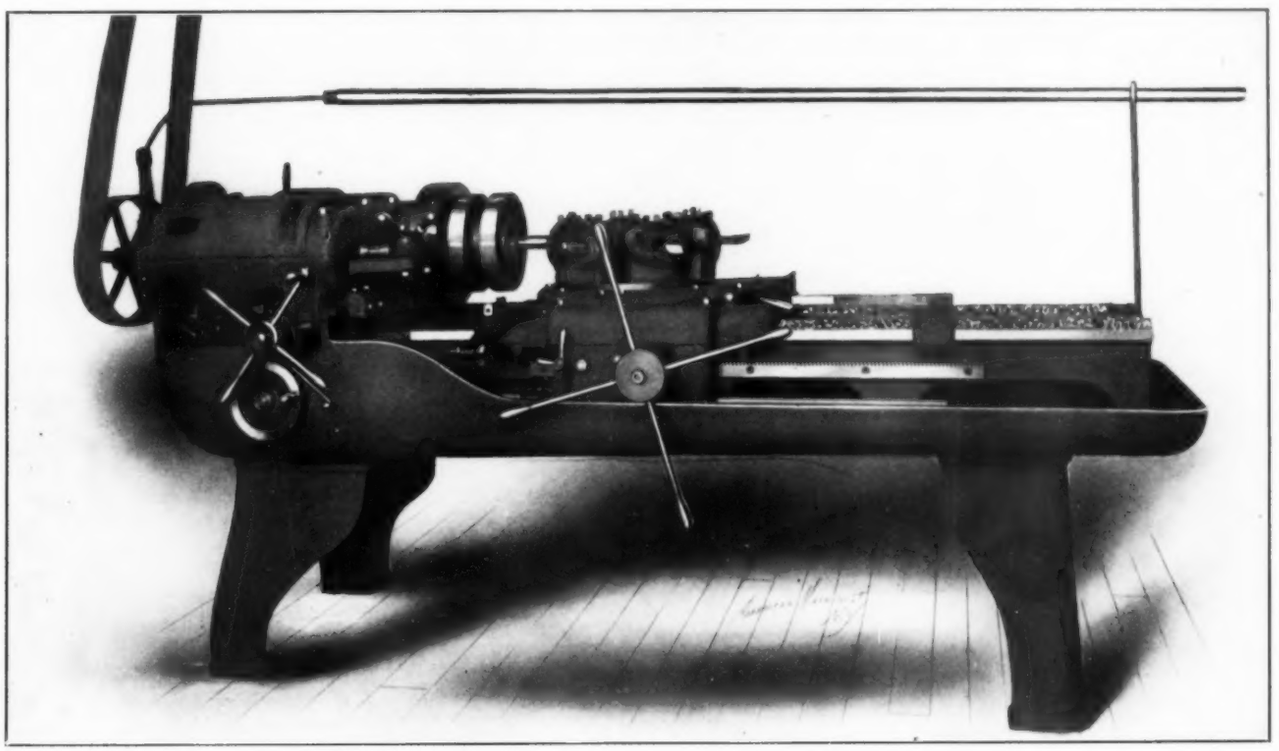


FIG. 1. FLAT TURRET LATHE WITH CROSS FEEDING HEAD.—SET UP FOR CHUCKING.

In the half-tone, Fig. 1, the machine is shown set up for a job of chucking, the work being a double gear blank, nearly a foot in diameter, and which, when finished, will be used on the spindle of one of these very machines. Several of the simple tools required for the various cuts are represented clearly in their holders; and the latter are arranged, as will be observed, so that a tool can be carried at either side of the center, or a drill, reamer or boring bar secured in the hole bored through the center of each holder.

The machine forming the subject of this particular photograph is a 3x36-inch with a 1⅝-inch chucking swing, the 2x24-inch having a swing for chucking of 12 inches. In all features of importance the two sizes are of practically the same design, with the exception of the geared mechanism in the head, which, in the case of the latter machine, gives the spindle eighteen rates of speed—or double the number of speeds at which the spindle of the larger machine may be driven. The additional speed changes are secured through the medium of several gears added to two of the shafts in the smaller head; the general arrangement, however, is so similar to the larger head that a description of the latter will answer all purposes. Therefore the sectional and end views given in Figs. 2 and 3 represent the head of the 3-inch turret lathe.

The spindle and its bearings, as will be seen from Fig. 2, are of unique construction, the spindle being straight from end to end except for a short distance at the rear where a slight reduction in the diameter is made in order to receive the roller feed. The threaded portion at the front end is of the same diameter as the spindle body, and the chuck screws up dead against the end instead of against the usual shoulder. The double driving gear is made fast to the spindle in the manner indicated and between this gear and a thrust web cast in the casing are two hardened and ground steel collars forming a thrust bearing, one of these collars being pinned to the gear and the other to the nut. At the front of the double gear is a third collar that is milled across the face to receive the ends of two screws which are tapped through lugs formed in the lower casting and which are adjusted against the collar to take up all end movement of the spindle. The spindle boxes are of most interesting design, being so arranged as to compensate automatically for wear. The gray-iron shell at each end of the spindle has a conical surface machined near the center, is split through at one side and is drawn into place in a conical seat by four helical springs pressing against lugs cast integrally with the box. Two split bronze shells are fitted in the box and oil is admitted between them to the spindle. The four springs acting on each box are just stiff enough to hold the taper shell firmly in place and keep the bronze bearings adjusted properly to the spindle.

An examination of the geared mechanism for driving the spindle will show that the plain pulley receiving the power from a motor or an overhead counter, is keyed on a shaft $A$ to which are pinned fast three small gears $a$, $b$ and $c$, meshing respectively with gears $d$, $e$ and $f$ mounted loosely on a second shaft $B$. Gear $d$ is chambered out at one side to admit a ratchet gear which is formed integrally with a spur gear $g$ keyed to shaft $B$; a silent pawl $h$, to be described later, forms, in conjunction with the ratchet gear, a connecting medium between gears $d$ and $g$, and thus shaft $B$ may be driven through gears $a$ and $d$ at a constant slow rate of speed. Between gears $e$ and $f$ is feathered a sliding double cone $i$ which may be moved to right or left to clutch either gear to the shaft $B$. This shaft then has three rates of speed, and, so long as the driving shaft $A$ is running, will rotate at

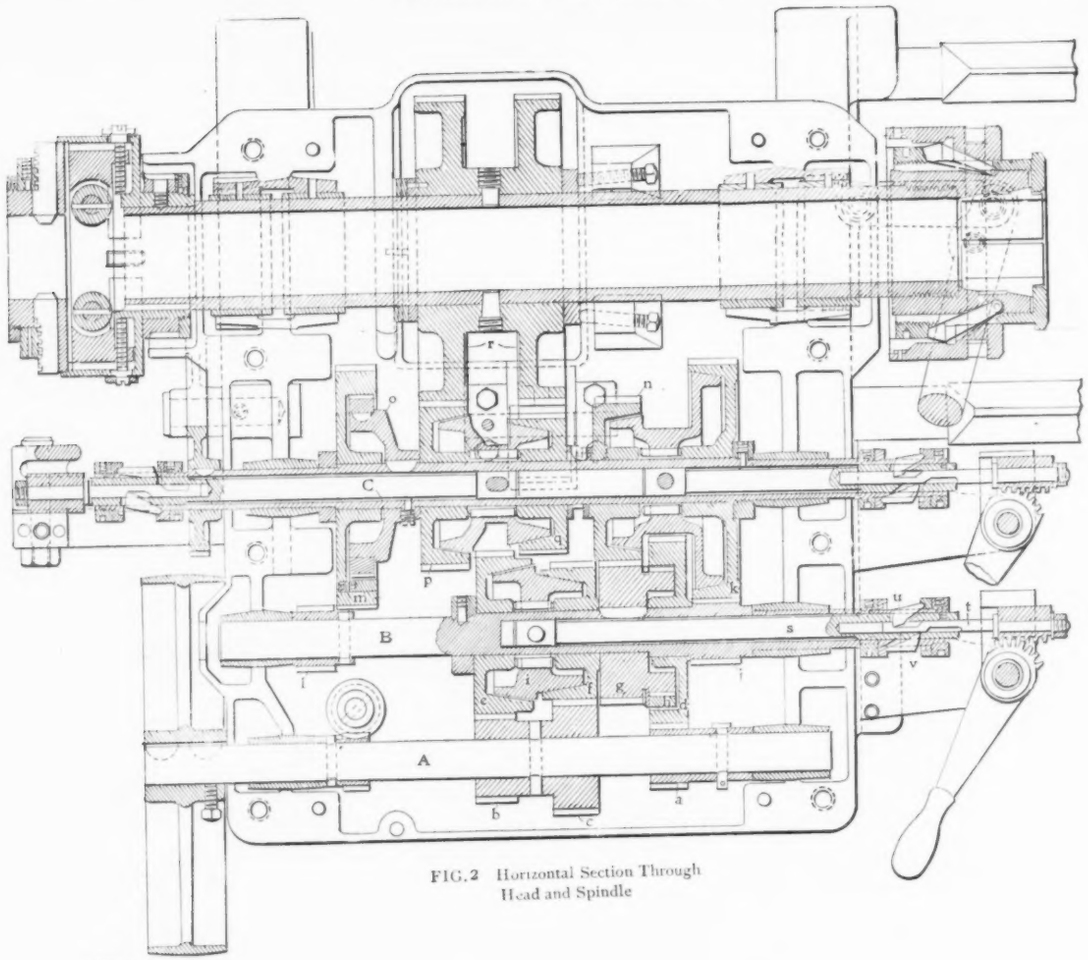



FIG. 2 Horizontal Section Through Head and Spindle

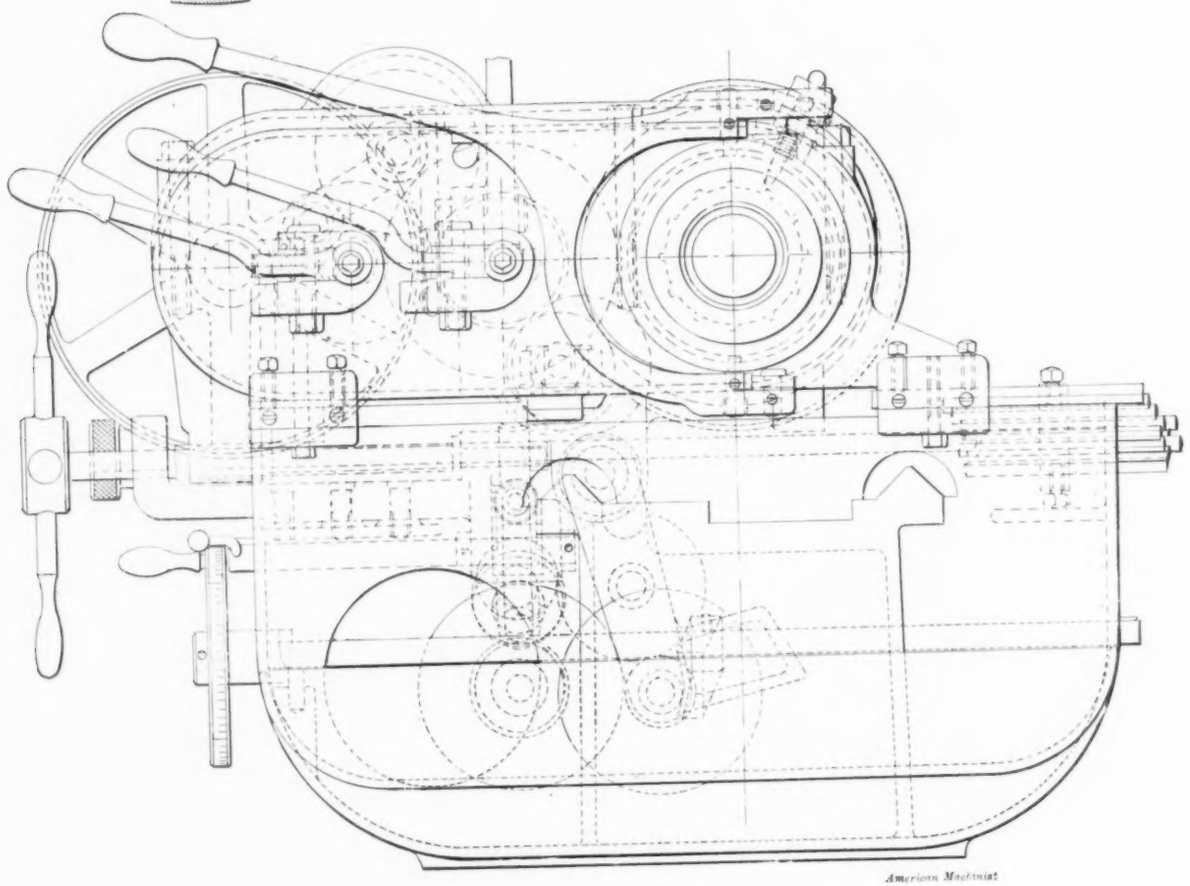



FIG. 3. END ELEVATION OF HEAD.

its slowest speed if friction clutch *i* is left in mid-position. If either friction gear is engaged, however, the shaft with gear *g* and its ratchet extension will, of course, simply run ahead of the slowly rotating gear *d* carrying the pawl *h*.

Near the right-hand end of shaft *B* is formed a pinion *j* which meshes with a gear *k* carried freely on shaft *C*; and near the other end of *B* is another pinion, *l*, which is connected by a compound intermediate (not shown) with a gear *m* also carried freely on third shaft *C*. Gear *g*, already noted, engages with another loose gear *n*, on shaft *C*, and between this gear and *k* is a sliding cone for clutching either to the shaft. Gear *m* is provided with the same form of pawl as that used in gear *d*, and this pawl, together with a ratchet gear *o* keyed to *C*, forms a means of driving this shaft through *m*.

It will be seen that this arrangement of gearing gives for each speed of shaft *B* three rates of speed for shaft *C*—or a total of nine speeds. These are transferred to the spindle through the medium of the two friction gears *p* and *q* and the large double gear *r*, gear *p* driving the spindle forward, and gear *q*, through an intermediate below, giving it motion backward. Both *p* and *q* are mounted freely on the shaft, as indicated, and, by the sliding cone between, either of the two may be thrown into action. With the cone in mid-position both gears will be free, and the spindle will of course remain inert.

The highest three rates of speed for the spindle are obviously derived from shaft *B* through gears *g* and *n*; the three intermediate or "back gear" speeds are through *j* and *k*; the three low or "triple gear" speeds are, of course, through pinion *l*, the compound intermediate (not shown), and gear *m*. The pawl and ratchet arrangement operated by the latter gear insures that, so long as shaft *A* is running, shaft *C*, like *B*, shall be rotated slowly until the speed is picked up by the throwing into action of one of the friction gears. Thus these shafts and their driving gears are never subjected to the strain to which they would be put were the shaft to be brought from a state of rest to comparatively high speed immediately.

The mechanism for shifting the various friction clutches will be easily understood: Taking for example the device as applied to shaft *B*, *s* is a sliding rod fitting the bore of the shaft and carrying near its inner end a pin which passes through a slot in the shaft and connects the rod with clutch *i*. The rod itself is drilled out longitudinally for some little distance from its outer end, and in the hole is slipped a rod *t*, which is provided with inclined surfaces at opposite sides to operate dogs *u* and *v*, which are pivoted and rest against the sides of adjustable collars as shown. When the rod is pushed inward by moving the handle to the right, *u* is lifted and the cam surface at its end bears against the bottom of the slot cut through *s* and causes that member to be forced to the left, engaging friction clutch *i* with gear *e*. When the operating handle is thrown to the left, cam *v* is swung out, drawing *s* to the right and causing gear *f* to be clutched to its shaft. The other frictions are all actuated in the same manner; the lever which controls the friction on shaft *C* for starting, stopping and reversing the spindle being operated by the long shipper rod located above the machine, as represented in Fig. 1. As each sliding cone has but a very slight movement on its shaft, it is essential that the gears which it engages be kept comparatively free from end play—that is, at a certain fixed distance apart. This is accomplished by fitting freely in the hub of each friction a series of spacing pins, two of which may be seen between the hubs of each pair of gears.

The silent ratchet and pawl arrangement referred to will be understood from the sketch, Fig. 4, the spur gear representing either gear *d* or *m*, Fig. 2. The pawl is dropped flush into a pocket in the face of the gear and on its inner face is doweled a thin plate *w*, which by a small spring is pressed against the inner face of the ratchet wheel. With the spur gear traveling in the direction indicated by the arrow to pick up the ratchet wheel, the pressure of plate *w* against the latter draws the pawl down into the position shown and into engagement with the ratchet teeth, the shaft carrying the ratchet then being driven at slow speed. When one of the faster gears is thrown into action and the ratchet wheel is rotated faster than the spur gear, the action of plate *w* is of course to lift the pawl clear of the teeth and hold it out of the way until the slow gear again becomes the driver for the shaft.

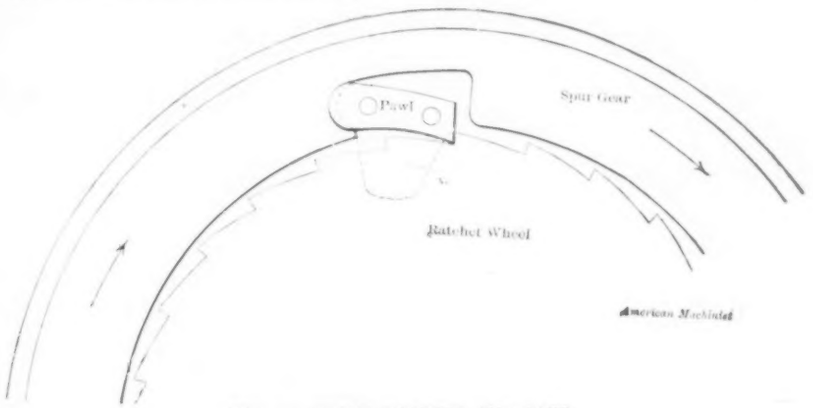



FIG. 4. SILENT RATCHET AND PAWL.

The spindle speeds obtained with the geared head with the driving pulley running at 450 turns per minute, range from 9 to 214 turns per minute, the various gears being so proportioned that each successive speed is practically 50 per cent. higher than the one immediately below it. In the smaller machine the advance in speeds through the eighteen changes is by 25-per-cent. increments.

The head is gibbed down to the bed in the manner represented in the different elevations, and is provided with a positive stop at the front to bring the spindle into alinement with the turret axis for bar work. The lower half of the head casting, in which the geared mechanism is mounted, is of course utilized as an oil pan, all gears running in the oil bath and the lubricant reaching every bearing.

The feed mechanism for the head and turret is actuated from shaft *C*, Fig. 2, through a train of gears leading down to the modified Sellers friction disks which are formed with curved faces as shown in Fig. 5. Here *a* is a gear fixed on the shaft referred to, and *b* a gear which is keyed on a short shaft *c*, this shaft driving through three other gears the disk *d* which is carried by a shaft at the bottom of a swinging yoke or bracket *e*, the latter being suspended from bearings having an axis in common with shaft *c*. By means of shaft *f* which is provided near its outer end with a cam *g*, the pivoted bracket is swung in either direction and disk *d* adjusted toward or away from the center of disks *h* (which are pressed together by springs, as shown), thus varying the speed at which these disks and their shaft *i* are driven. The latter shaft operates the feed rod for the carriage, and it also drives through bevel gears an inclined shaft *j* which actuates through worm and worm-wheel the cross-feed screw *k* for the head. The worm shaft is mounted at the lower end in a spherically seated box; and the upper end may be lifted or dropped sufficiently to engage or disengage the worm and wheel, by a small handle shown immediately behind the pilot wheel on the feed-screw.

The disk at the front of the cam shaft *f* is marked to represent various rates of feed for both the head and carriage, one complete turn of plate and cam giving the entire range of feeds, *i. e.*, from about 0.007 to 0.085 inch per turn of spindle. The throw of the cam and the swing of the driving disk is only one-half inch; but the curvature of the disk faces is such that in this half-inch movement the contact, say, on the driver travels from a point 3 13-16 inches from the center to

a point only one inch from the center; in other words, the drive is transferred from a 7⅝- to a 2-inch circle.

The ten stops for the cross-feeding head are clamped in a holder or sleeve journaled in the rear of the bed, as represented in the end view Fig. 3; the rod by which they are controlled is shown broken off at *l*, Fig. 5. These stops are turned one after another into line with the stop on the head, by the knurled knob at the front end of the rod, and the head upon coming in contact with one of them is held there firmly until the feed worm is released by the operator. In the same manner the flat turret saddle when fed up to one of its twelve stops is kept against that stop until the feed is disengaged by hand; thus the tools are held up to their work and have no opportunity to jump back and score the finished surface. Moreover, with the constant pull on the carriage, shouldered pieces are produced with the highest degree of accuracy, as the operator has no occasion here to force the tool up by the pilot wheel, as is usually done in facing shoulders to length.

The device by which the turret feed is controlled is placed on the feed rod at the front; a similar device is used on the oblique feed shaft under the head. Fig. 6 will make the construction clear, this showing the mechanism as applied to the operation of the turret slide or carriage. In this view *a* is the feed rod, but this rod, instead of carrying a worm direct for operating the feed gearing in the apron, carries a sleeve at *b*, which in turn is fitted with a right- and a left-hand worm formed on the same body, this double worm giving the forward and reverse feeds for the turret slide and doing away with the necessity for the upside-down turner formerly employed when turning work by feeding away from the chuck. The sleeve *b* is not fastened to rod *a*, the latter having instead a cylindrical case at *c* fitted with a feather and sliding on the splined feed rod. At the other end of *c* is a threaded disk *d* closing the end and forming an adjustment for the interior mechanism. This consists of two hardened and ground rings *e* and *f* and a C-spring *g*. Parts *e* and *f*, which are loose on sleeve *b*, are ground true on their outer faces to match the inner surface of disk *d* and the face of the flange *h* formed on the end of the sleeve. Two opposite cam surfaces shaped much like long clutch teeth are formed on the inner face of each ring *e* and *f*, and at one side these are turned down sufficiently to allow the stiff C-spring *g* to be slipped into place, the outside diameter then corresponding with the diameter of the two rings or cam disks. The ends of the spring abut against the square ends of the wedges or teeth, thus forming a spring connection between *e* and *f*. A key at *i* connects *e* with case *c*, causing it to rotate with the splined rod; and the bracket supporting the right- and left-hand worm behind the apron of course draws the entire device along the feed rod as the carriage is shifted to and fro.

The C-spring pressing the angular surfaces together forces disks *e* and *f* against flange *h* and adjusting nut *d*; and the latter is set up so that the load on the feed due to the heaviest work put on the machine will be carried through the gripping of the flange on worm sleeve *b* between member *f* and the seat formed at the bottom of the hardened cylindrical case *c*. When the turret slide comes up against one of the fixed stops the tendency is for the C-spring to open slightly, and for the side thrust of the cam disks to be reduced, the device then transmitting just enough power to hold the slide firmly against the stop.

The shell *c* now rotating while the sleeve is stationary, a pair of spring pins *j* strike rapidly on teeth formed on the flange *h* and create a clicking sound, which notifies the operator that it is time to re-

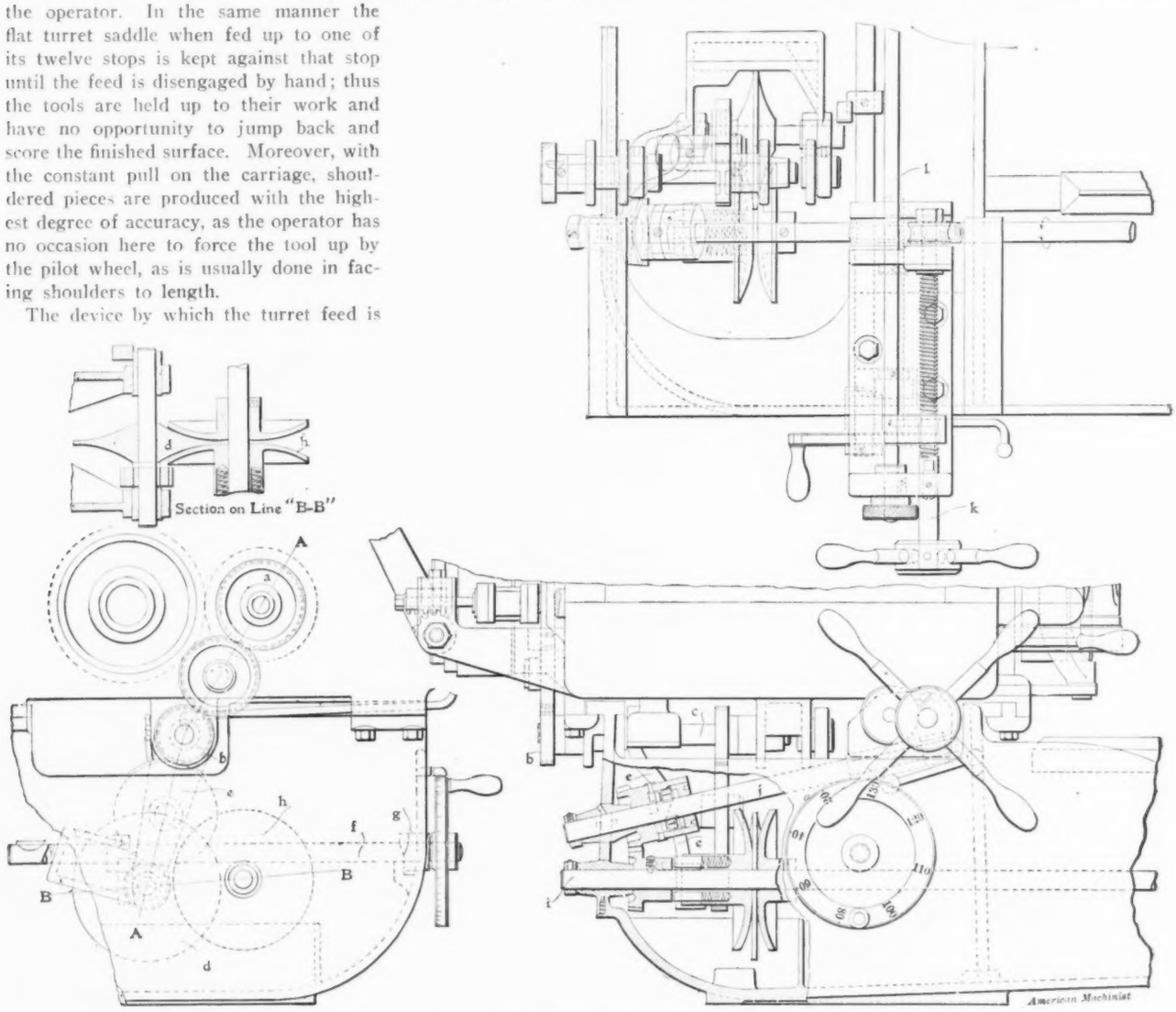



FIG. 5. FEED MECHANISM UNDER HEAD.

lease the feed worm; this he does by lifting a small cam handle at the side of the worm bracket lever in front of the apron. In a similar manner the device on the worm shaft for feeding the head warns the operator when the head is dead up to a stop.

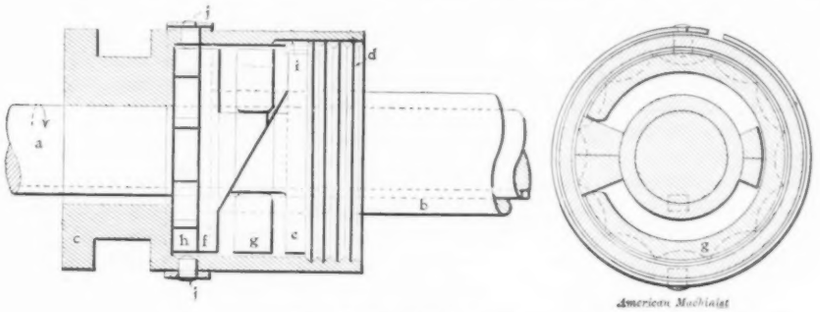



FIG. 6. FEEDING DEVICE.

The worm carried on sleeve *b* and cut right hand at one end and left hand at the other, meshes with a single worm wheel in the apron, this wheel being finished with both right- and left-hand hobs, so that it will run equally well with either worm. The worm sleeve may be easily shifted in its bracket to bring either worm under the worm wheel, and, when properly located, is positively held against end movement relatively to the bracket.

The twelve stops for the turret slide giving each tool two different stopping points are arranged as in Fig. 7, this drawing showing also the rack and gear by which the flat turret, when rotated, is started at a very slow but gradually increasing rate of speed and then as easily brought to rest, the speed of rotation decreasing through the latter part of the movement, and the turret coming practically to a standstill just as the locking pin is ready to spring into place.

The gear by which this is brought about is placed, as shown at *A*, under the ratchet wheel turning the turret; it has teeth resembling those of a sprocket wheel, and the one at *B* is somewhat longer than the others. The end of rack *C* is really a wedge, and the first gap cut in the rack is of sufficient length to allow the inclined surface to come in contact with tooth *B*, and by its wedging action to start the turret very slowly, before the second tooth is engaged by the second tooth of the rack. In approaching the end of the movement, the rack teeth, through the curvature of the top, cause the turret to turn at a decreasing rate of speed, which reaches zero as the index bushing registers with the locking pin.

The twelve stops will be seen at *D*, the reversible stop bars E, with which they are adapted to engage, being of the same design and held in the same way as the six bars formerly employed in the 2x24 machine. The stops D are fitted vertically in a holder in the saddle, and will drop of their own weight when released by supports *F* and bar *G*. Parts *F* are wedge shaped at the rear to engage notches formed in drops *D*, and, at the front, rest against the periphery of the turret. For each support there is a semicircular recess in the turret edge, and

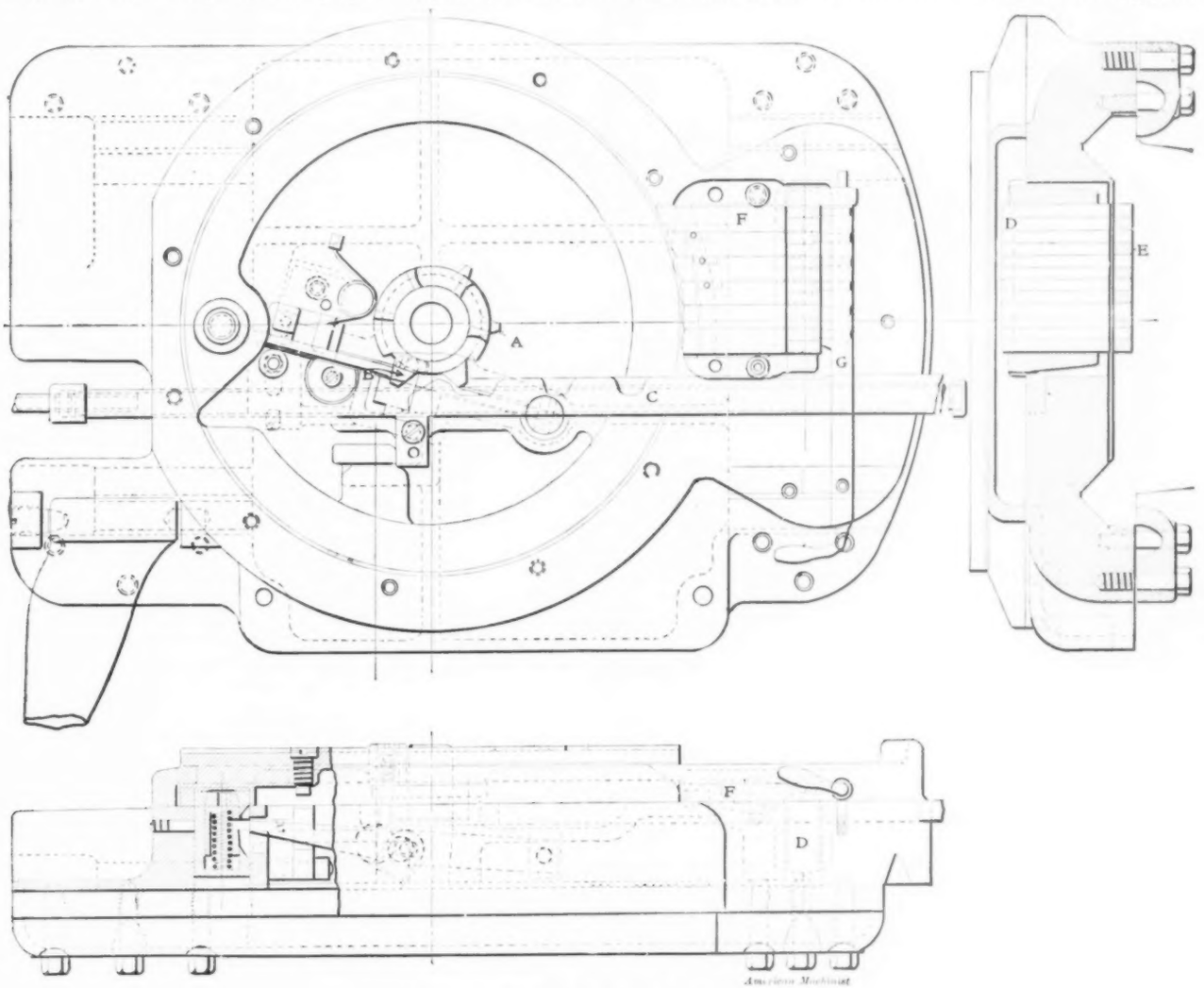



FIG. 7. THE TURRET SLIDE AND ITS STOPS.

these pockets are staggered, three alternate pockets being in a plane at the lower edge of the turret, and the intervening three in a plane above. The projecting lips at the front of bars *F* are formed, three at the bottom of the supports and three at the top, to match their openings in the turret. As the latter is turned and a tool brought into working position, the corresponding wedge *F* at the rear slides into its recess and allows one of the stops *D* which it has held up to drop on to the stop-bar below, where it travels with the turret slide until engaged by the notched end of the bar. Were it not for the device *G* two stops would, of course, drop when released by one of the sliding pieces F; but this affair with its six pins holds up every other stop, as in the drawing, or it may be set to hold up the entire twelve and give the turret slide a clear movement of any desired distance without interference. A spring plunger holds rod *G* in any one of three positions, and it is a simple matter, therefore, to push the rod in and pick up six of the stops, draw it out to hold up the other six, or move it to mid-position and hold the twelve clear.

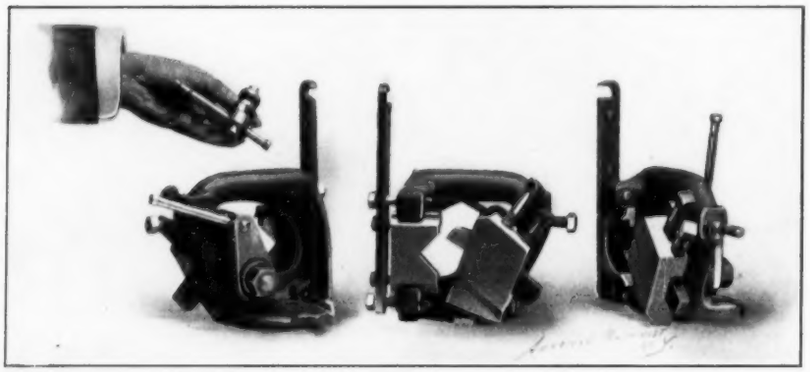


FIG. 8. ONE OF THE TURNING TOOLS.

The advantages of this system of double stops will be apparent to anyone familiar with turret-lathe operations, it making it possible to work each tool to two definite stopping points, and, in connection with the cross-feeding head, permitting, say, a boring tool to bore a hole to a certain depth, face a shoulder and then bore another size to a second shoulder or clear through the work; or, where the machine is set up for a certain piece of work and a short job is required at will, it may be set up and run off without disturbing the adjustments for the other work. Especially is this arrangement of stops valuable in connection with the new turner used on the machine and illustrated in Fig. 8, this tool having a double cam or eccentric for setting the tool to two different diameters of work, and a double back-rest strap for giving the back-rest jaws two different positions corresponding to the tool settings. Thus with the one tool a piece having two diameters on the body may be easily turned, or a roughing cut may be taken with the first position of the tool and a finishing cut with the second, the change from one size to the next being made instantly.

The turner is made with reversible back-rest jaws to precede or to follow the cutting edge of the tool, and has a hollow body through which oil is forced to the work, each tool as it comes into working position receiving the lubricant from a device located under the turret and supplied by a pump driven through spiral gears in the head. F. A. S.

---

An illustrated article in the June number of the *Magazine of Commerce* describes the works of Hadfield's Steel Foundry Company, Limited, of Sheffield. The works of the company cover eighty acres. The steel foundry itself covers six acres, is 1,020 feet long, and is the largest of its kind in the world. The company is the largest maker of projectiles in the world. Mr. R. A. Hadfield, the chairman and managing director, has a European reputation for research in metallurgy. The last of the numerous honors conferred upon him is that by the Iron and Steel Institute of the Bessemer Gold Medal. There really seems little left for Mr. Hadfield to win. In 1902 the Institution of Civil Engineers (the largest technical society in the world, having over 7,000 members), awarded him the Howard prize and premium of 65 guineas, which is only awarded once in five years. The last recipients of this honor were Sir Lowthian Bell, Bart., and Dr. Bauermann, F. R. S., and previously Sir Henry Bessemer and Sir W. Siemens. On previous occasions the same society awarded him the George Stephenson and the Telford gold medals. The French Société d'Encouragement pour l'Industrie Nationale and the Franklin Institute have also conferred upon him high honors. His great invention is that of manganese steel.

---

In California they built a pipe line 280 miles long for conveying oil from the Kern River district to San Francisco Bay. The oil is so thick that it took five days for it to travel the first thirty-seven miles, and the job as planned has been abandoned for other arrangements.

### A Rational Basis for Wages.

The paper with the above title, by Harrington Emerson, presented at the recent meeting in Chicago of the Mechanical Engineers of Great Britain and America, and which we here reprint, provoked lively discussion and remark, and many of our readers will peruse it with interest, tho of course not all will agree with it in all points, and some perhaps not in any point. The paper is as follows:

Both the coal operator and the wage earner know better what they are selling than the average manufacturer knows what he is buying, whether coal or labor, and as a consequence the latter usually has the worst of the bargain, which is wholly his own fault. I couple coal and labor because there is much ultimate similarity between them as objects of contract. The coal operator aims to sell tonnage. He owns a mine, whose quality he cannot change; he mines by the ton; he pays freight by the ton, and if you will let him he will sell by the ton, persuading the railroad, factory purchasing agent or other customer that coal is coal; no difference except in his price, which he is willing to shade a little below that of competitors. The purchaser who knows his business is not deluded by a ton price, particularly not if he is running a torpedo boat or cruiser on a premium trial trip. He buys what scales do not weigh, namely, *power*, and if the factory manager can get power by the metered kilowatt he will forget all about coal. If he cannot obtain measured electric power or water power, he must create his power by means of a heat engine, and here again he is lucky if his fuel can be metered to him in cubic feet of natural gas, or in barrels of crude oil, both of these substances having a very accurate number of heat units, for the gas, per cubic foot at constant temperature and pressure; for the oil, per gallon or pound.

In comparing the relative value of coal, oil or natural gas, the consumer can only be guided by the cost in dollars of brake horse-power, and if he is wise he will purchase coal by the ton, perhaps, but strictly on a basis of dollars per thermal units. When a ton quotation is made, the sensible purchaser adds to the delivered price the cost of unloading, shrinkage, cost of delivering to furnace-room, cost of removing ashes, thus obtaining the total cost of the coal as used in the furnace. He will then analyze the coal, make a calorimetric or experimental test of its heating value, and thus determine the relative cost of the heat units in the coals offered. If he does this he will invariably find that the best coals are the cheapest. It costs on the average no more to mine poor coal than to mine good coal, probably not as much; it costs no more to carry to market good coal, and the man operating a seam of good quality is just as anxious to increase his tonnage, and thus

add to his margin of profit, as the owner of a poor seam. As the majority of dealers and purchasers make but little allowance for difference in heating value, the owner of the best seams has to shade his price almost or quite to the level of the price of the poorer coals of his competitor for *tonnage*. Within the last year I have seen a large concern buy, at over $6 a ton, imported English coal of 11,000 British thermal units—coal with which steam could not be maintained and later in the same year this firm made chemical analysis and calorimeter tests of coals offered, securing for $3.10 a coal of 15,300 British thermal units. The first coal was bought because at the time it seemed cheap per ton; the second was bought solely because it was low in price per heat unit. It is evident that two coals do not always have the same relative value at different places. At Nome, in Alaska, I have seen coals sell at $75 per ton, owing to the cost of transportation, the expenses of landing, of carrying inland, of dealers' profits. If, in a camp near Nome a coal of 10,000 British thermal units is worth $75 a ton, then a coal of 15,000 British thermal units is worth $112.50 a ton. Deduct from both the cost of delivery from Seattle to mine, say $71 a ton, and it becomes evident that the purchaser should not have hesitated to pay if necessary $41.50 for the better coal rather than $4 for the poorer fuel. I knew but one man at Nome far-sighted enough to realize that what he was paying for was heat units, so he imported and used crude oil.

At the furnace door the connection between dealer and buyer ceases. After having sold British thermal units, the dealer is not further concerned as to what use the buyer makes of the coal. One buyer will put in the best boilers he can secure, install a condensing, triple-expansion engine and obtain a horse-power from 1 pound of coal. Another buyer will with the same coal be content to obtain a horse-power for 7 or 8 or even more pounds of coal.

In the economical consumption of coal three considerations enter: (1) The market price per ton; (2) the quality of the coal; (3) the efficiency of use; and all three must be considered to obtain heat units cheaply. Prices are quoted per ton to the purchaser, who should determine qualities and buy on a basis of heat value and not of weight, and finally he should use what he has bought so as to obtain highest results.

What would we think of the dealer who demanded a higher price per ton because the purchaser had better boilers and engines? Yet, on the other hand, the dealer is debarred from asking a price based on his heat units because his mine conditions and competition force him to sell by the ton. The buyer, not the seller, is in the stronger position. In contracting for labor the manager should consider it just as he does coal and buy it in the same rational and unusual manner.

The wage earner, like the coal operator, is forced to sell what he always has; namely, time. The employer, who is not interested in fuel tons, is also not interested in the wage earners' hours and minutes, but solely in low cost of production, and this he can only secure through the quality and efficiency of the labor he employs, only indirectly and remotely from the hours the employee gives him. The wage earner is not selling *output*, nor is the employer buying *output*, and any attempt to base wages on *output* is as irrational as to base the price of coal on boiler and engine efficiency.

There was a time when labor was in a condition of status. The worker was entitled to a living more or less generous, and under pressure he turned out more or less work, just as sheep pasture their owners' ranges and peacefully submit to a shearing. By political economists and students of sociology the substitution of contract for status has been heralded as a great advance, just as the substitution of coal bought by the ton for wood gathered without measure from the forest was an advance. Under contract the wage earner is supposed to receive an agreed upon wage and to render a definite service, just as the ton of coal is supposed by those who know no better to be a definite measure of heat supply. This crude basis of demanding a surrender of time and leaving the particular service to the whim of the employer worked fairly well with certain passive services, in which time rather than effort and intelligence constituted the equivalent. Time reward was probably originally based on military or naval service, in which long periods of idleness alternated with hours or days of frenzied effort, much as firemen are employed today—a profession in which pay cannot be gaged by performance. It is also probable that many of the earlier wage earners were employed more for the sake of ostentatious display than for what they produced, survival of which we still see in the barbaric splendor of two postillions, a coachman and two footmen, all in gay livery, taking one poor man or woman driving. It is time the industrial world moved away from such prototypes, whether military or ostentatious, and by advocating an entire departure from the military type of management for factories our honored member, Mr. Fred W. Taylor, plans a reform far-reaching and deep.

Military and naval idleness, ostentatious time-serving are not wanted in modern intensive production, and anything of the kind should be more obnoxious to the self-respecting producer, who is directly debased by it, than to the employer who cannot help but feel in a measure exalted by considering himself a captain of hundreds of thousands. I have heard that in England a manufacturer who employs 1,000 men can find admittance to gentlemen's clubs, but the man who employs less than the magical number, 1,000, cannot. It would follow that if a non-progressive father bequeathed to a progressive son an establishment with 1,000 employees, and the latter was able, by the introduction of better machinery and modern methods, to turn out more and better work with half the men, even though he doubled their wages, he would debase himself socially.

There is a mental laziness in talking about dollars and days, as if either were a humanly measurable quantity. The cost of living may go up or down, and I have heard men say that there were certain five minutes in their lives which they would not exchange for other months. When the wage earner sells time the employer does not necessarily obtain anything, not even as tangible an asset as a ton of very poor coal. Just as the coal operator has foisted tonnage on his client, so the foolish employing class has forced the wage earner to foist *time* on his employer—time of no value in itself; and the employer, blind to the essentials of the transaction, builds up an elaborate system of time checks and time-keeping (both of which are merely incidentals and not essentials in good system) to the utter neglect of matters much more important.

Some thinking employers, realizing that *time* in itself has no value, have endeavored by means of piece work to buy *output*. The analogy of coal has already shown that *output* does not enter properly into the contract between employer and wage earner. When he sells his time, the wage earner does give something of value to himself, even if it may have none for his employer, but he can no more accurately and justly sell output than the coal operator can sell horse-power from a boiler and engine over which he has no control. It might on occasion be convenient temporarily to measure the merit of the wage earner by his output, just as it might be convenient to measure the value of a coal by the horse-power obtained from it in a given power-house; but the moment a new power-house is put up, the moment a wage earner is coupled up with better facilities, the purchaser falls back on the market price of coal and on the market price of skilled labor. In buying coal the wise purchaser was advised to buy by the ton, to base his price on quality and to use efficiently. He should act similarly when he buys labor.

It is perfectly possible to find an equitable basis for reward, at once just to the employer who wants something more tangible than the abstraction *time*, and to the wage earner who is already too precariously dependent on uncertain wages, when what he really wants is a steady living. The wage earner, like the lawyer, has four different things to sell: (1) His time and liberty; (2) his skill, profession or trade; (3) his intelligent co-operation; (4) his power to do harm. *Output* is not

among these, nor is it, except in rare, and generally distressing, cases, like sweat-shop work, what he does or can sell.

A living daily wage is due to every man who signs away his liberty to another, whether he stands around idly to glorify his employer or to amuse himself. This minimum wage is a matter of contract. It should be due the man whether he is present or absent, as long as he remains on the pay roll. This is the wage payable as equivalent for assignment of time and loss of liberty. This part of compensation I shall call minimum wage. Above this minimum he should receive when at work at his trade a different and larger sum, equivalent to the current wages of his trade, but in reality made up of two distinct parts, namely, the minimum wage and an increment due to him for his profession or trade. We have in this the basis of the present daily wage system relative to time. Beyond this, however, for future just and peaceable relations between employer and employee, comes the most important part of the wage earner's reward, namely, what is due him for exceptional and unusual co-operation either of mind, body or both. I believe that in the old days of privateering the sailor who first sighted a vessel subsequently captured was entitled to special prize money, and in war, actions of exceptional personal gallantry are specially rewarded.

From the nature of the case this third increment of wages, corresponding to the contingent fee of the lawyer, must be fluctuating, payable some days and others not, because earned some days and others not. In many cases the earning of this professional wage does not imply harder or most exhausting work, but more intelligent and co-operating work. It implies use of heart and head in addition to use of hands and eyes. We might say that these three forms of wages are paid respectively: (1) For use of body; (2) for use of hands and eyes; (3) for use of head and heart. It is foreign to this paper to discuss the fourth form of wages due to the ability to do harm. This wage may be no better than the extortion of the blackmailer or the ransom of the brigand, or it may be as legitimate as the fee paid a lawyer to keep out of a case.

As the State fixes the minimum age and the maximum hours at which children may be employed, it might also, at least by example, fix the minimum living wage below which no one should accept employment, and thus fix a minimum standard. Supply and demand, modified to some extent by the unions, will determine the second wage, and the third is a matter to be left wholly to employer and employee, even as are to-day lawyers' and doctors' fees.

The employee has everything to gain by a system of strict and accurate records which will enable him to establish his own value and worth, and on the basis of which, if he changes location, he may be eagerly sought elsewhere. Whoever heard of a lawyer, when he moves to a fresh location, taking with him from the mayor of his old town a certificate that he has left honorably? The official court records show whether he has won cases or lost them; whether he has been a blackmailer or faithful to his clients. Why should not the machinist going to a new location say: "Here is the record of work I have done. I know so well how to do what is wanted; to combine machine performance with best cuts, feeds, speeds, as to lower materially the average cost of production of any operation I undertake. I expect, firstly, current machinists' wages, and, secondly, I expect so much more for my special skill."

The theory and application of triple wage can best be illustrated by a concrete example, for which I shall select the case of a locomotive engineer—a man belonging to one of the strongest and most conservative unions, receiving high wages owing to long training, special skill and great responsibility. Such a man should be allotted a fixed daily rate of minimum wages, to be paid whether he runs or not, whether he is sick or well, whether he is suspended or in good standing. The amount of this daily wage is determined by agreement at time of receiving appointment.

Secondly, under the usual terms of his own or his union's agreement with the company, he receives, when on his runs, definite and agreed upon compensation due to him because he is an engineer in charge of a train and under orders, whether standing on side track or running sixty miles an hour. There is, however, a great difference in engineers and in firemen, who should be jointly considered with engineers. One engineer and his fireman will send into the shop in short time every engine they run on. Another engineer and fireman succeed in getting the utmost out of their engine, even under the most trying conditions of service. It is just here that the difference comes in between man and man for which at present there is scant, or no recognition—a difference that corresponds to difference in heat units of coals.

In one of the largest of American railways the cost per mile for wages of engineers, firemen and wipers, the cost per mile for coal and the cost per mile for locomotive repairs is practically the same, being respectively $0.0946, $0.0999 and $0.0867. This is an average for the whole road, but for the heaviest engines both repairs and fuel are relatively greater. It is in the second and third items that there is abundant opportunity for railroad companies and their engine crews to combine to effect a saving in which both are to share, and the relative rights of each party are not to be guessed at or conceded as a gratuity or bonus, but are to be based on scientific detail study as reliable as the determination of heat units in coal or the efficiency of a boiler or engine. What encouragement is there to an engineer to work and toil over an engine that some other engineer has shamefully neglected? What encouragement is there to him to try to put an engine into the best of condition if the next man that takes it will allow everything to run down and go to ruin?

An engine costs twice as much to-day as a few years ago, and four times as much is expected of it. The wear and strain are in every way greater, and the repairs have become more costly. It is easier by omission of *unusual* care to cause damage, more expensive to make it good; yet these new conditions have not been met by any corresponding change in the relation between employer and employee. I leave to others who know more about this particular subject of engines than I do to evolve an equitable basis of mutual gain to both parties. I can imagine, however, that it might be possible to give the man with the best record the pick of certain engines, the selection of his own fireman, and, in addition to paying him by the day and by the regular run basis, to give him an ever-increasing rate in proportion to the number of miles his engine runs without getting into the shop. When at last the engine has to be sent there he is laid off on the day-wage basis, possibly with the privilege of superintending the repairs, until it goes into service again. I can think of other methods of accomplishing the same desirable end, namely, securing the earnest, constant co-operation of those in charge of the engine, in keeping it in good repair.

Companies know the average run of their engines, the average cost of repairs per mile run, the average earnings of the engineers and firemen. All the data are at hand to put into effect the three rates of wages.

It will at once be objected that engines must be pooled in order to make more miles than they will if assigned to one crew. This objection may be urged against this particular example, but not against the principle urged, yet even for the example no one who has not studied the subject thoroughly and exhaustively has authority to speak with finality. I know of no data available. It is a curious fact in railroad and other machine shops that clerks and facilities are lavished for *money* accounting but elementary help begrudged for shop records; also that betterments and improvements that would yield 100 per cent. profit on their cost are not made simply because the records *pro* and *con* do not exist. It would be possible to work out this engine crew problem so as to obtain maximum of engine service, maximum care of engines, maximum wages to crews, minimum of repair costs and lessened expense to companies. On large

ocean steamers engine crews alternate, not promiscuously but definitely, and on a railroad there need be no hard and fast rule one way or the other, but a scientific adjustment of equipment to conditions, so that some engines would have only one crew, other two engines have three crews, with chief engineer, and first and second assistants, and some few emergency engines have no regular crews. These matters require trouble and study, but so does the running of trains on time. The latter part of railroad operation has reached a high state of perfection, but the adjustment of engineers, engines and company interests to one another is as yet very elementary. A system that is applicable to engineer and fireman is also generally applicable to other craftsmen. It is a principle I advocate, not an isolated case, each one of which will vary in method.

There are only two ways of obtaining the lowest cost of production: first, a relentless and ceaseless study and direction of details by the officials who plan and control, and, secondly, an intelligent and eager co-operation of the employee, which cannot be equitably asked for without generous special compensation. It is simply a question of what is most profitable.

In industrial matters, whether production or wages, there is no possibility of permanent stagnation. Whether we export or import, whether we depend on home markets or on colonies, prosperity is ultimately based on the world's crops, and these depend on the variable rains from heaven. There are fat years and lean years, and it is only such a one as Joseph who is able to use the fat years to corner the grain market and the lean years to enslave the Egyptians forever. When work is abundant, employment increases, wages rise; when work is slack, employment decreases and wages fall, a double loss to the wage earner—dearth of employment being far more serious than lower wages, and in this respect the census and other reports dealing with rise and fall of wages have been most misleading. The question is only very slightly whether the average wages per year of those actually employed are higher or lower, but whether more or or less are employed *in their own trades* at reasonable wages.

It is a reflection of the intelligence of the State that when so much is done to correct nature, to dredge harbors, build sea walls, impound waters, regulate rivers, fight against diseases; when so much more is meddled with that might be better left alone, absolutely no use is made of the great power of the State to act as a flywheel for the energy of production. Here at least is something in which the interests of employers and employees are one. When labor is scarce and materials high, governments, national, State and municipal, should carefully abstain from undertaking great works of creation or improvement, but when labor is plentiful and materials low in price governments should carry out plans held in reserve for just such conditions. There is no other means at once so powerful and economical to minimize the ups and downs of both labor and capital. It is in the power of government to establish a minimum wage (as well as a minimum price for great staples) at which it is always ready to undertake great elementary works of public utility—dredging canals, for instance, or opening roads. In some such manner as this would I have the State take a hand in helping to fix the minimum wage.

On the other hand, every wage earner should keep constantly in view the possibility of obtaining a much higher rate than the average: a rate wholly due to his own reputation and accomplishment; a rate far above the minimum offered by government, also much above the mean due him as an able-bodied, skilled, trustworthy craftsman. This extra rate must always be based on the fact that he is more skillful or valuable than the average. He may be more skillful to-day, just as a prize-fighter may be the champion of the world to-day, but next year both may be no more than mediocre. He must constantly excel if he would constantly command a professional price. It is, however, not necessary to wait for the slow action of an unintelligent and unmindful government. Every employer can test the cost of production as he can the cost of horse-power, and he should make it his business to know what he can afford to pay for quality; and the employer who systematically seeks quality will find that the best coal and the most efficient labor sell for less than their relative worth.

Believing as I do that the man, machine and method efficiency of the average railroad or machine shop is far below what it might be, often not more than one-third to one-half of the ideal, I cannot but regard disputes over wages as the effect rather than the cause of unsatisfactory and unscientific relations between employer and employee. If the employers had been wiser there might perhaps never have been union antagonism, only reasonable bargaining as there is to-day between lawyer or doctor and client. It is the employee's privilege to try to obtain higher wages and shorter hours, but not as an inducement to offer *less work*, nor yet, perhaps, more work, but *better work*, a more efficient combination of man, method and machine.

---

In one of the technical schools a new time and stock card is used in connection with the students' work in the machine shop. The student, before beginning a job, puts down his estimate of the time required, and the actual time taken on the job is recorded when the job is finished. A comparison of the actual time and the student's estimate of the time with a regular time allowance shows the student the value of his skill and judgment and stimulates him to increased care and precision.

### Rubber Culture in Mexico.

Edward M. Conley, Vice and Deputy United States Consul-General at the City of Mexico, gives in *Consular Reports* an extremely interesting and informing account of the rubber industry. The aim of the paper seems largely to discourage speculation in schemes of rubber production by those of small means or of insufficient or incorrect information. He says, in part:

Theoretially, rubber culture is a very alluring proposition, but thus far it has never yielded any practical results. There is as yet no good reason to believe that its cultivation in Mexico will prove any more successful than it has in other countries. The cultivation of rubber is based upon the supposition that the supply of wild rubber will one day be exhausted or greatly curtailed, but this hypothesis is entirely uncertain. Most Americans have an idea that rubber is a product like wheat or corn, to be obtained from a given tree. The idea is quite erroneous. It has been estimated that 1,000 different species contain rubber, tho commercial quantities have been obtained from only forty or fifty. A South American going to New England for the purpose of producing maple sugar and planting a grove of maple trees of a different species from that which produces maple sugar would be considered a ludicrous figure. How, then, should an American be considered who goes to the Tropics to raise rubber and sets out a plantation of rubber trees without knowing anything of the botany of the numerous rubber producing species? It has been found by experimenters in other countries that a rubber producing tree which will flourish in any given locality will not necessarily yield rubber. The first experiments in rubber culture were naturally made with the Para rubber tree, the one best known. It was planted in regions which were apparently exact duplicates of those where the wild tree grows, but for some reason the experiments were absolute failures.

Mr. Lionel de Pinto, of London, one of the owners of the Mano Marquez plantation, near Playa Vincente, Oaxaca, Mexico, in a recent interview says that the question of harvesting the product of the cultivated rubber tree is a very serious one, upon which largely depends the future success of rubber cultivation. Even the Indians, who gather wild rubber, are beginning to realize the importance of saving the life of the tree and not destroying it entirely in order to obtain the maximum yield at the first tapping. But under cultural conditions the expense of collecting the milk will necessarily be greater than that of collecting the milk from wild trees, since the protection of the life and health of the cultivated trees will necessitate the extraction of smaller amounts of milk with the use of better tools and the exercise of greater care, which means higher priced labor. Here the question suggests itself, how can a company buy a tract of land, even at a very low price,

clear it, plant it in rubber, wait several years for its development, and then compete with the natives of uncivilized regions, who gather the wild product in their own unvalued time?

Rubber culture is a very complex problem and it cannot, by any stretch of imagination, be said to have passed the experimental stage; indeed, it is not very far advanced in that stage. If men of millions, who could afford the experiments, were the ones making them there would be no necessity for commenting upon them, but it would seem to be better business judgment for persons of small means to invest their money in a known industry rather than in such an uncertain undertaking.

---

An interesting wall map has been published by the Stanley Electric Manufacturing Company, Pittsfield, Mass., showing some long lines of electric transmission in California. The location of eight widely distant power-houses is shown, and the lines running from them to various cities of the State, such as Marysville, Sacramento, Stockton, Santa Rosa, San Rafael and San Francisco. The longest present distance transmission shown is 232 miles, from De Sabla power-house to Sausalito, across the Golden Gate from San Francisco. Several hâlf-tones are given on the map, showing interesting scenes in connection with the water transmissions and the power-generating plants. The map suggests at a casual glance that a cable across the Golden Gate would save many miles of overland line.

## The Flow of Steam Through Nozzles.

BY A. M. LEVIN.

Problems relating to the flow of steam through nozzles involve figures which are, with no other data at hand than what is generally supplied by the handbooks, most difficult and tedious to get at. As such problems, however, are becoming of more and more frequent occurrence, they constituting, in a way, the foundation of the steam turbine theory, it is believed that the following method for their solution may be of interest:

The percentage of moisture contained in the steam has a decided influence on the velocity with which the steam issues from the nozzle and on the weight discharged per unit of time, and it is principally the necessity of finding a correct value of this percentage, after the steam has expanded in the nozzle, that tends to make the computations laborious. To save the repeated calculations, therefore, of this percentage, Tables 1, 2, 3 and 4* will be found to be very convenient, and with the help of these, together with the usual tables of the properties of steam, any problem relating to the flow of steam can be solved with comfort.

Each one of these tables refers to a certain assumed initial percentage of moisture. Table 1 refers to originally dry steam, Table 2 to steam of 10 per cent. moisture, Table 3 to steam of 20 per cent. moisture, and Table 4 to steam of 30 per cent. moisture. The first column of all the tables gives the absolute initial pressure of the steam, the second gives the corresponding temperature, and the following columns give the state of saturation of the steam, after it has expanded adiabatically from the pressure and temperature opposite the head figure of the column, successively, to another pressure and temperature as given in the first two columns.

For instance, if steam of 185 pounds absolute pressure, or 375 degrees of temperature, containing 10 per cent. of moisture (= 90 per cent. saturation), expands adiabatically to a pressure of 30 pounds absolute, or 250 degrees, what is then the moisture it contains?

Follow column 4, Table 2, beginning with 90 per cent. saturation at a temperature of 375 degrees, down to the line headed by 30 pounds and 250 degrees, where will be found the figure 0.817. That is 81.7 per cent. saturation, or, what is the same thing, 18.3 per cent. moisture.

It happens, of course, that we may want to expand the steam to a pressure and temperature which the tables do not give. In such a case we have to interpolate between the temperatures which are given in the table. As the saturation varies quite regularly with the temperature of the steam—not so, however, with the pressure—it is necessary, for the sake of interpolation, to express the condition of the steam by its temperature rather than by its pressure. The relation between the pressure and the temperature we find from the tables of properties of steam.

| Abs. Pressure lbs. pr. sq. in. | Temp'r degrees Fahr. | SATURATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 250 | 406 | 1.000 | | | | | | | |
| 185 | 375 | 20 0.980 | 1.000 | | | | | | |
| 135 | 350 | 20 0.960 | 21 0.979 | 1.000 | | | | | |
| 97 | 325 | 20 0.940 | 21 0.958 | 22 0.978 | 1.000 | | | | |
| 67 | 300 | 20 0.920 | 21 0.937 | 22 0.956 | 23 0.977 | 1.000 | | | |
| 46 | 275 | 21 0.899 | 21 0.916 | 22 0.934 | 23 0.954 | 24 0.976 | 1.000 | | |
| 30 | 250 | 22 0.877 | 22 0.894 | 22 0.912 | 23 0.931 | 24 0.952 | 25 0.975 | 1.000 | |
| 19 | 225 | 21 0.856 | 22 0.872 | 22 0.890 | 23 0.908 | 24 0.928 | 25 0.950 | 26 0.974 | 1.000 |
| 12 | 200 | 21 0.835 | 22 0.850 | 22 0.868 | 23 0.885 | 24 0.904 | 25 0.925 | 27 0.947 | 28 0.972 |
| 7 | 175 | 21 0.814 | 23 0.828 | 22 0.846 | 23 0.862 | 24 0.880 | 25 0.900 | 27 0.920 | 28 0.944 |
| 4 | 150 | 21 0.793 | 22 0.806 | 23 0.823 | 24 0.838 | 24 0.856 | 26 0.874 | 27 0.893 | 28 0.916 |
| 2 | 125 | 21 0.772 | 22 0.784 | 23 0.800 | 24 0.814 | 25 0.831 | 26 0.848 | 28 0.865 | 28 0.888 |
| 1 | 100 | 21 0.751 | 22 0.762 | 23 0.777 | 24 0.790 | 25 0.806 | 26 0.822 | 27 0.838 | 28 0.860 |

TABLE 1. DRY SATURATED STEAM.

| Abs. Pressure lbs. pr. sq. in. | Temp'r degrees Fahr. | SATURATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 250 | 406 | 0.900 | | | | | | | |
| 185 | 375 | 15 0.885 | 0.900 | | | | | | |
| 135 | 350 | 15 0.870 | 16 0.884 | 0.900 | | | | | |
| 97 | 325 | 15 0.855 | 16 0.868 | 17 0.883 | 0.900 | | | | |
| 67 | 300 | 16 0.839 | 17 0.851 | 17 0.866 | 18 0.882 | 0.900 | | | |
| 46 | 275 | 16 0.823 | 17 0.834 | 17 0.849 | 18 0.864 | 19 0.881 | 0.900 | | |
| 30 | 250 | 16 0.807 | 17 0.817 | 17 0.832 | 18 0.846 | 19 0.862 | 21 0.879 | 0.900 | |
| 19 | 225 | 16 0.791 | 18 0.799 | 17 0.815 | 18 0.828 | 19 0.843 | 21 0.858 | 22 0.878 | 0.900 |
| 12 | 200 | 17 0.774 | 18 0.781 | 18 0.797 | 19 0.809 | 20 0.823 | 21 0.837 | 22 0.858 | 23 0.877 |
| 7 | 175 | 17 0.757 | 18 0.763 | 19 0.778 | 19 0.790 | 20 0.803 | 21 0.816 | 22 0.834 | 23 0.854 |
| 4 | 150 | 17 0.700 | 18 0.745 | 19 0.759 | 19 0.771 | 21 0.782 | 22 0.794 | 22 0.812 | 23 0.831 |
| 2 | 125 | 18 0.722 | 19 0.726 | 20 0.739 | 20 0.751 | 21 0.761 | 22 0.772 | 22 0.790 | 23 0.808 |
| 1 | 100 | 18 0.704 | 19 0.707 | 20 0.719 | 20 0.731 | 21 0.740 | 22 0.750 | 22 0.768 | 23 0.785 |

TABLE 2. STEAM CONTAINING 10 PER CENT. OF MOISTURE.

*These tables have been calculated for the English system of weights and measures by following Zeuner's method for finding the variation in the saturation of steam at adiabatic expansion. It is believed that they are practically correct. The arrangement of the tables was originated by Prof. J. E. Cederblom.

Example—Steam of 135 pounds absolute pressure and 10 per cent. moisture expands adiabatically to 5 pounds absolute pressure. What will the percentage of moisture be? Five pounds absolute pressure we find corresponds to 162 degrees. By following column 5, Table 2, from 350 degrees and 90 per cent. saturation down to the line opposite 150 degrees we find the figure 0.759. The temperature is, however, here 162° — 150° = 12° lower than what we required; therefore as we note that the difference between the temperatures given in the table is 25 degrees, and the difference between the percentage of saturation for an expansion of 25 degrees, at this place, is 0.019, we must increase the figure 0.759 with

$$\frac{12}{25} \times 0.019 = \frac{48}{100} \times 0.019 = 0.009,$$

$$\frac{9}{25} \times 0.017 = \frac{36}{100} \times 0.017 = 0.00612,$$

and deducting this from 0.768 the result will be 0.762.

In case the original percentage of saturation is not what any of the tables assume, then we must figure out two different results, by following the tables having assumed initial percentage of moisture on each side of the actual one, and interpolate between these results.

For instance: Steam of 185 pounds absolute pressure, or 375 degrees of temperature and 86 per cent. saturation, expands to 30 pounds absolute pressure, or 250 degrees. What percentage of saturation will it have after the expansion?

We have found, from Table 2, that steam of 90 per cent. saturation, expanding between these temperatures, will contain 0.817 parts dry steam, and in the same way we find from Table 3 that steam of 80 per cent. saturation, expanding between the same limits, will contain 0.741 parts dry steam, and from these results we get that steam of 86 per cent. saturation, after expanding to 250 degrees, will contain $0.817 - \frac{4}{10} 0.076$, or 0.787, parts dry steam.

The formula generally used for finding the velocity of steam flowing through a nozzle, or aperture, is the so-called Zeuner's formula for adiabatic expansion. This formula has a rather formidable appearance, but it can, for practical purposes, be simplified to a quite appreciable extent. However, as it is well to know exactly what approximations have been made in any formula with which we get familiar, it may be best to give the formula as it originally looks. It reads:

$$w^2 = \sqrt{\frac{2gE\left(h_0 - h + r_0 x_0 - rx + \frac{\sigma}{E}(p_0 - p)144\right)}{1 - \left(\frac{F \cdot v_0}{F_0 v}\right)^2}} \qquad (1)$$

The different letters signify as follows:

$w_2$, velocity of steam in feet per second at mouth of nozzle.
$p_0$, $p$, pressures in pounds per square inch absolute.
$v_0$, $v$, volumes in cubic feet of 1 pound of steam.
$F_0$, $F$, areas.
$h_0$, $h$, heat in the water, in heat units.
$r_0$, $r$, latent heat in the steam, in heat units.
$x_0$, $x$, degree of saturation of the steam.
$g$, acceleration due to gravity=32.16.
$E$, mechanical equivalent of heat=778.
$\sigma$, volume of 1 pound of water=0.016 cubic feet.

Subscript $_0$ refers to initial conditions, and no index to final conditions.

For average practical purposes we can use, instead of formula (1), the following:

$$w^2 = 223\sqrt{h_0 - h + r_0 x_0 - rx} \qquad (2)$$

which contains but few variables, all of which we can readily find in the tables referred to above. $h_0$, $h$, $r_0$ and $r$ we find from tables of properties of steam.

$x_0$ is to be assumed, or given by the the problem, and $x$ we find from Tables 1, 2, 3 and 4, in the way described in the foregoing.

| Abs. Pressure lbs. pr. sq. in. | Temp'r degrees Fahr. | SATURATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 250 | 400 | 0.800 | | | | | | | |
| 185 | 375 | 10 0.790 | 0.800 | | | | | | |
| 135 | 350 | 10 0.780 | 11 0.789 | 0.800 | | | | | |
| 97 | 325 | 11 0.769 | 11 0.778 | 12 0.788 | 0.800 | | | | |
| 67 | 300 | 11 0.758 | 12 0.766 | 12 0.776 | 13 0.787 | 0.800 | | | |
| 46 | 275 | 12 0.746 | 12 0.754 | 13 0.763 | 13 0.774 | 14 0.786 | 0.800 | | |
| 30 | 250 | 12 0.734 | 13 0.741 | 13 0.750 | 14 0.760 | 14 0.772 | 15 0.785 | 0.800 | |
| 19 | 225 | 13 0.721 | 13 0.728 | 14 0.736 | 14 0.746 | 15 0.757 | 15 0.770 | 16 0.784 | 0.800 |
| 12 | 200 | 13 0.708 | 14 0.714 | 14 0.722 | 15 0.731 | 15 0.742 | 16 0.754 | 17 0.767 | 18 0.782 |
| 7 | 175 | 14 0.694 | 14 0.700 | 15 0.707 | 15 0.716 | 16 0.726 | 16 0.738 | 17 0.750 | 18 0.764 |
| 4 | 150 | 14 0.680 | 15 0.685 | 15 0.692 | 16 0.700 | 16 0.710 | 17 0.721 | 18 0.732 | 18 0.746 |
| 2 | 125 | 15 0.665 | 15 0.670 | 16 0.676 | 17 0.683 | 17 0.693 | 17 0.704 | 18 0.714 | 19 0.727 |
| 1 | 100 | 15 0.650 | 16 0.654 | 16 0.660 | 17 0.666 | 17 0.676 | 18 0.686 | 19 0.695 | 19 0.708 |

TABLE 3. STEAM CONTAINING 20 PER CENT. OF MOISTURE.

| Abs. Pressure lbs. pr. sq. in. | Temp'r degrees Fahr. | SATURATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 250 | 400 | 0.700 | | | | | | | |
| 185 | 375 | 5 0.695 | 0.700 | | | | | | |
| 135 | 350 | 5 0.690 | 6 0.694 | 0.700 | | | | | |
| 97 | 325 | 7 0.685 | 7 0.687 | 7 0.693 | 0.700 | | | | |
| 67 | 300 | 7 0.676 | 7 0.680 | 7 0.686 | 8 0.692 | 0.700 | | | |
| 46 | 275 | 7 0.669 | 8 0.672 | 8 0.678 | 9 0.685 | 9 0.691 | 0.700 | | |
| 30 | 250 | 8 0.661 | 8 0.664 | 9 0.670 | 9 0.674 | 10 0.681 | 10 0.690 | 0.700 | |
| 19 | 225 | 9 0.652 | 9 0.655 | 9 0.660 | 9 0.665 | 10 0.671 | 11 0.679 | 11 0.689 | 0.700 |
| 12 | 200 | 9 0.643 | 10 0.645 | 10 0.650 | 11 0.654 | 11 0.660 | 11 0.668 | 12 0.677 | 12 0.688 |
| 7 | 175 | 10 0.633 | 11 0.634 | 11 0.639 | 11 0.643 | 12 0.648 | 12 0.656 | 13 0.665 | 13 0.676 |
| 4 | 150 | 11 0.622 | 11 0.623 | 11 0.628 | 12 0.631 | 12 0.636 | 13 0.643 | 13 0.652 | 13 0.662 |
| 2 | 125 | 12 0.610 | 11 0.611 | 12 0.616 | 12 0.618 | 13 0.623 | 13 0.630 | 14 0.638 | 14 0.648 |
| 1 | 100 | 13 0.598 | 12 0.599 | 12 0.604 | 13 0.607 | 13 0.610 | 14 0.616 | 14 0.624 | 14 0.633 |

TABLE 4. STEAM CONTAINING 30 PER CENT. OF MOISTURE.

In formula (2) we have eliminated

$$\frac{\sigma}{E}(p_0-p)\,144.$$

That this term, which represents the energy that has been supplied by the feed pumps in feeding the water into the boiler, is quite small compared with the rest of the radical, we can be convinced by inserting the different figures for an average case.

For instance, if $p_0 = 135$ and $p = 1$, then

$$\frac{\sigma}{E}(p_0-p)\,144 = \frac{0.016}{778} \times 134 \times 144 = 0.4.$$

This result is insignificant compared with the other terms of the square root which amounts to from 30 to 280, as we shall presently see.

The denominator of the original formula becomes 1, when the initial velocity with which the steam is supplied to the nozzle can be considered equal to 0—that is, if the supply pipe is large compared with the nozzle. In most practical cases there will be no error caused by calling the denominator equal to unity. However, there may be special cases where the supply pipe is small or where the difference in pressures is insignificant, when it would not be right to do so.

The weight of steam delivered per square inch of section of the nozzle per minute is

$$G = \frac{w}{x\,u + \sigma} \times \frac{60}{144} \qquad (3)$$

where

$G$ = weight of steam per square inch per minute in pounds,

$x$ = the amount of saturation of the steam,

$u$ = volume of 1 pound of dry steam of a pressure corresponding with the existing velocity in cubic feet,

$\sigma$ = the volume of 1 pound of water in cubic feet = 0.016 is so small compared with $u$ that it can be entirely disregarded.

We obtain therefore the simpler expression

$$G = \frac{w}{x\,u} \times 0.417 \qquad (4)$$

In regard to the proper form of the nozzle, in order to insure the required amount of expansion of the steam, it is evident that the various sections must be of such size as to allow the same weight of steam to pass all; remembering that the amount passing per square inch is determined, as seen by equation (4) by the velocity, density and amount of saturation existing at the different sections.

This requirement is expressed by the formula:

$$\frac{w\,F}{x\,u} = \frac{w_0\,F_0}{x_0\,u_0} = \frac{w_m\,F_m}{x_m\,u_m} = \frac{w_2\,F_2}{x_2\,u_2} \qquad (5)$$

Fig. 1 gives at a glance the meaning of the various subscripts.

At that section of the nozzle where the pressure is about 58 per cent. of the initial pressure, the conditions of speed, density and saturation of the steam are such as to cause a flow of steam greater per square inch of area than at any other section. The area of the nozzle is therefore at this point the smallest, and from here it becomes divergent to the mouth.

If we call the total weight of steam in pounds required to be delivered per minute $R$, then the chief sections of the nozzle would be:

$$F_m = \frac{R}{G_m} \quad \text{and} \quad F_2 = \frac{R}{G_2}.$$

Or, comparing the delivery end of the nozzle with the section at the throat, we get

$$F_2 = \frac{G_m}{G^2}\,F_m.$$

The energy stored in the steam, when it issues from the nozzle, is for each pound

$$L = \frac{w_2^2}{2\,g} \text{ foot-pounds} \qquad (6)$$

and the theoretical minimum weight of steam required per horse-power hour is

$$W = \frac{127{,}000{,}000}{w_2^2} \text{ pounds per hour} \qquad (7)$$

After having, in the preceding, collected the necessary formulas, we are now ready for a practical example.

Example—Steam of 135 pounds absolute pressure, containing 10 per cent. of moisture, is required to expand adiabatically in a nozzle to 1 pound absolute. (1) What will the speed be at the throat and

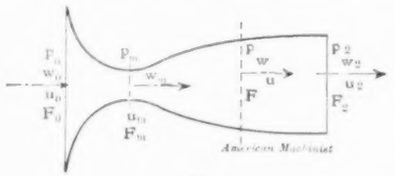



FIG. 1.

at the delivery end? (2) How much steam will this nozzle deliver per square inch of section of the throat? (3) What will be the required relative areas of the throat and delivery end? (4) What minimum amount of water would be required per horse-power hour if all the energy could be taken out of the steam?

The pressure at the throat will be

$$0.58 \times 135 = 78 \text{ pounds.}$$

The following data we get from tables of properties of steam and from Tables 1, 2, 3 and 4.

| Steam pressures in pounds. | | Temperatures. | $h$ | $r$ | Saturation. | $u$ |
|---|---|---|---|---|---|---|
| Initial, | 135 | 350° | 322 | 867 | 0.900 | 3.29 |
| At throat, | 78 | 310° | 281 | 896 | 0.873 | 5.5 |
| At mouth, | 1 | 100° | 70 | 1043 | 0.719 | 334 |

The velocity of the steam at the throat:

$$w_m = 223\sqrt{h_0 - h_m + r_0 x_0 - r_m x_m}$$
$$= 223\sqrt{322 - 281 + 867 \cdot 0.9 - 896 \cdot 0.873}$$
$$= 223\sqrt{39}$$
$$= 1392 \text{ feet per second.}$$

The velocity of the steam at the mouth:

$$w_2 = 223\sqrt{322 - 70 + 867 \cdot 0.9 - 1043 \cdot 0.719}$$
$$= 223\sqrt{282}$$
$$= 3745 \text{ feet per second.}$$

We note here that the values under the square root are in these cases 39 and 282, against which the energy 0.4 supplied by the boiler feed pumps, and which we have eliminated, is of no practical consequence.

The weight of steam delivered per square inch of the throat per minute will be

$$G_m = \frac{w_m}{x_m\,u_m} \cdot 0.417 = \frac{1392}{0.873 \times 5.5} \cdot 0.417$$
$$= 121 \text{ pounds per square inch.}$$

The weight of steam delivered per square inch of the mouth will be

$$G_2 = \frac{w_2}{x_2\,u_2} \cdot 0.417 = \frac{3745}{0.719 \cdot 334} \cdot 0.417$$
$$= 6.5 \text{ pounds per square inch.}$$

The required area of the mouth will be

$$\frac{G_m}{G_2} \cdot F_m = 18.6 \text{ times the area of the throat.}$$

The minimum amount of water per horse-power hour would be

$$W = \frac{127{,}000{,}000}{w_2^2} = 9 \text{ pounds per hour.}$$

---

### Mechanical Progress in Japan.

We have a letter from Chas. A. Francis, of Tokyo, in which he says:

"Japan is taking rapid strides in the mechanical line, but owing to the fact that it is wholly a new branch of trade with them, and their not having the advantage our young men have in inheriting mechanical ability, they cannot do as accurate work as Americans, as they have not yet learned it.

"Tho American tools are being shipped into Japan in large quantities, their finer points are not as fully appreciated as they would be if the young men could serve a four years' term, as the American young men do, to learn the trade properly.

"The Japanese students I find very anxious to learn, and with the very short time each student has to spend in the mechanical laboratory, I am sometimes greatly surprised with the rapid progress they make.

"There is one thing which tries the patience of instructors, and that is their wishing to overlook to some extent the small things and taking up the more difficult subjects before they have fully learned the primary essentials, which are always necessary in every line of work."

We learn that the growing interest in the mechanical line has led the best teachers in the lower mechanical schools to apply to the board of education to give a special summer course for their benefit, and this board and the president of the Higher Technological School of Tokyo have asked the assistance of Mr. Francis in the matter. He has agreed to give a special course in the mechanical engineering department to cover about five weeks during the summer vacation, beginning August 1. The course will include all the practical branches in machine work as far as possible, as this is the point most needed. Laboratory work to consist of twenty-nine hours per week, and in addition to this he will give three lectures per week of two hours each, the subject of which will be modern machine tools.

## Forming Sheet Metal Parts Using Water as a Medium.

BY WARTARD STARK.

The art of forming parts from sheet metal has made such strides in the past few years that only those actively engaged in this class of work can expect to keep thoroughly posted.

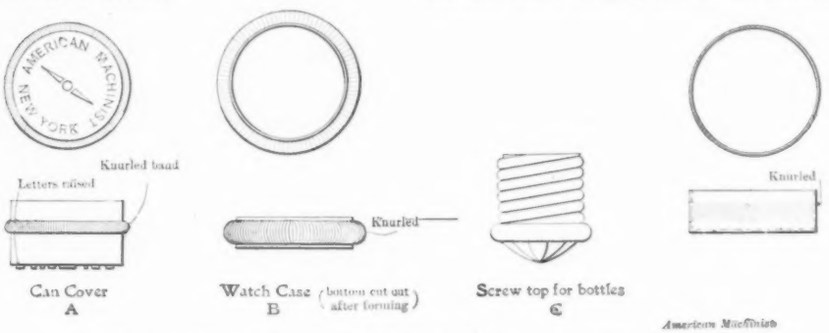



FIG. 1. FORMING SHEET-METAL PARTS USING WATER AS A MEDIUM.

The finished parts shown at Fig. 1 were produced at one stroke, using water as a means for forcing the metal into dies. Undoubtedly, if the value of water as a forming medium were more widely known, many manufacturers who are producing this class of sheet metal work, using either wax, rubber, expanding metal forms, spinning or other means, would certainly discard them and adopt water. It is true that wax, when under pressure, will force the metal into dies just as well as water, but as the wax adheres to the formed part, it therefore necessitates melting it in order to remove it. A piece of soft spring rubber made to fit freely in the cup to be formed, is much better than wax. The rubber will, when under pressure, force the metal into the dies, and when pressure is removed the rubber assumes approximately its original shape, and is easily extracted. The only objection to the use of rubber is that it appears "dead" and crumbles after a few hundred parts are formed. If continued in use *under the same pressure* after the rubber starts to crumble, it will not produce a properly formed blank. Therefore if rubber be used it means either a new piece every two or three hundred blows or a gradual increase of pressure. The use of expanding metal forms for forming such blanks as shown at *B* entails a series of operations to produce the finished blank. As water does not compress (noticeably), it requires no further argument to convince one that water is about the best and cheapest medium for forming sheet metal parts. The dies for forming this class of work are of course made in halves, and for best results a *drop press* is used, because an instantaneous pressure can be obtained. The dies are beveled at edges, and one half is rigidly held in bolster, while the other half is gibbed and adjusted to slide by means of the lever *E*. But if dies are to produce such parts as *A* and *C*, having a raised design or letters, the dies are made as at *G*. A bushing of tool steel containing the design is inserted in the bolster and flush with face of it. If design or letters were stamped in the bottom of the dies proper, it would not be possible to open the dies, when formed part is in them, without injuring the design. It is a good plan to make a dovetailed holder to hold the dies while turning out to the desired shape. The holder being gibbed permits the diemaker taking babbitt impressions of die, when an impression of the desired shape and dimensions is obtained it should be carefully kept, as it may be of great value in alining the dies, should they spring in hardening. After hardening, the dies should be lapped where the two halves come together, to insure a good joint. The babbitt impression is then placed in the dies and the dies soldered together at each end. The bottom of the dies is ground level, then the top and lastly the beveled edges. They are then properly adjusted in bolster *H*, and when the dies are together the joint *I* should be in a locked position. The punch *J*, which fits nicely the part *F* of die, is securely fastened to the hammer, which is then lowered until the punch is below face of dies. The bolster is moved so that the rigidly held half of the die bears against the punch and the dies closed on punch and bolster securely fastened to press. The cup to be formed is then placed in the die with the cup filled with water, and the fall of the hammer regulated so that the cup will be properly formed. In producing such blanks as *A B*, having a knurled band, it is better to knurl the blank as at *D* and regulate the fall of the hammer so that the cup will just form without injuring knurl, than to attempt to *cut the knurl in dies*. (This process is patented; patents were pending in 1900.)

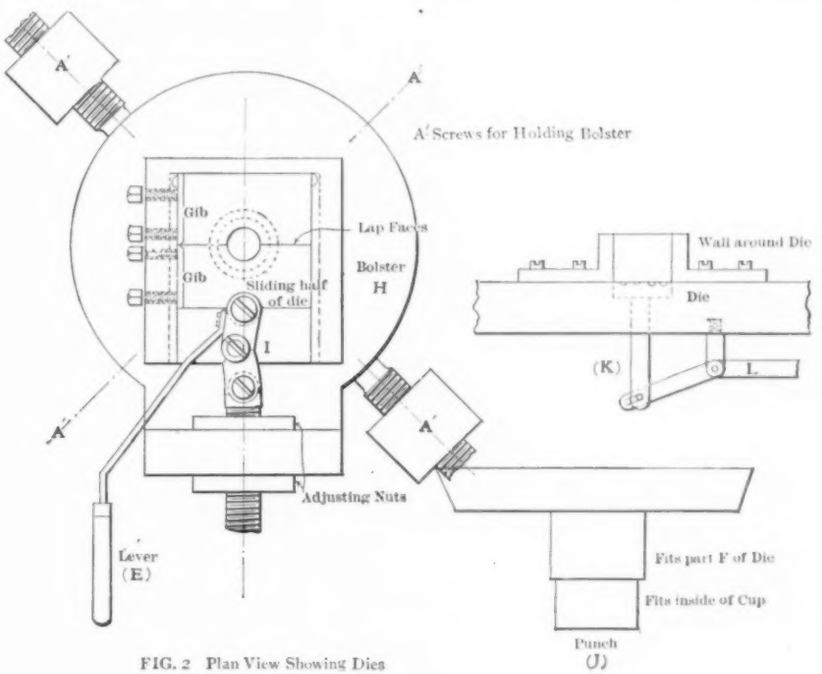
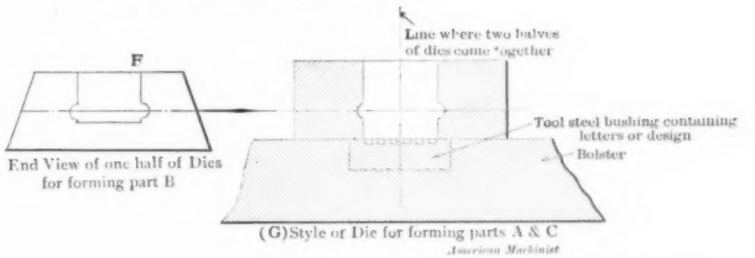



FIG. 2 Plan View Showing Dies in Position in Bolster.


Line where two halves of dies come together
F
Tool steel bushing containing letters or design
Bolster
End View of one half of Dies for forming part B
(G) Style of Die for forming parts A & C
American Machinist

FORMING SHEET-METAL PARTS USING WATER AS A MEDIUM.

The use of water is not limited to cup-shaped parts by any means, but can be advantageously used for striking up most any embossed *flat* work, simply by building a steel or gray-iron wall around dies to confine the water. The punch and piece to be formed of course must fit within the walls reasonably close to prevent too much

water escaping. When striking up *flat* embossed work, the dies are made, as at *K*, in the form of a plunger, and the lever *L* is used for forcing out the formed piece. Several small holes are drilled clear through the bolster to allow the water to escape, should any get under plunger. This style of die can also be used to good advantage for striking up small pieces from thin metal on an ordinary power press, by fastening a plate of spring rubber to the face of a flat punch.

### The Engineer in the Foundry.*

BY R. MOLDENKE.

It is not so very long ago that when an engineer had to do some detailing in which cast iron was used, he simply figured on a strength of 10,000 pounds per square inch, and let it go at that. Today more is required of a man up in his profession. Where the use of cast iron is advantageous, it makes quite a difference whether ordinary cupola metal is employed or the highest grade gun metal. In other words, the engineer should know something of the several kinds of cast iron made, how they are made and how used to the best advantage.

The best indication of this modern tendency is seen in the recent presentation of specifications for testing cast iron and finished castings. These arose from the demand of the buyer to know what he is paying for, and as a consequence he is learning to specify his wants more clearly. Then also there is the desire of the engineer to acquaint himself with a material he is called upon to inspect for the buyer, and pass upon as good for the purpose or not. Finally the foundryman himself, in his most broad-minded form, has always been desirous of giving the customer the best he can make, and indeed must do this or find his product replaced by the malleable or steel casting. All these tendencies have brought about a general getting together of those most interested, with the result that for the first time in the history of the iron industry has a common ground been found for working specifications governing the testing of cast iron and its products. We will therefore look into this subject more closely, and see how the engineer can utilize his knowledge of metallurgy in dealing with the foundry.

For the purpose of the engineer we can divide the general subject cast iron into the following heads: The metal without subsequent extended annealing, or all classes of cast iron proper; and with subsequent extended anneal, or malleable cast iron. I say extended anneal to distinguish the removal of the casting strains simply in any kind of casting by the application of moderate heat for a short time only from the long annealing given a special class of white iron which is unfit for use in its condition as it leaves the molding floor, but becomes tough and malleable as well as just short of steel in strength after the heat treatment has been applied

Cast iron may be further divided into the gray varieties and the chilling irons. The gray varieties may again for our purpose be divided into the ordinary jobbing castings, such as for buildings; the machinery irons, light, medium and heavy; the special irons made in the furnace, which run up to 35,000 pounds per square inch and over; and finally the softer irons, such as would find their best application in ornamental work. Stoves, art castings novelty work, etc., would come in here. There are some sub-classes to be considered here, such as iron for pipe cylinders, refractory metals for grate bars, and the stuff only good for sash weights and floor plates.

In the chilling irons we find first the car-wheel iron, which is both soft and hard, depending upon the mold it has been cast into; the roll irons, and special work, such as for crusher jaws, grinding mills and the wearing parts of machinery.

It will be easily seen how the civil engineer will be specially interested in cast iron going into railroad and bridge construction, whether for actual working parts or merely the ornamental end. Similarly in the designs of buildings, whether terminals or skyscrapers. The mechanical engineer naturally has more to do with cast iron and runs through the whole gamut in his daily practise. In the railroad service he deals with malleable as well as gray iron castings in his car construction. The locomotive adds some steel castings to these. Then the cast iron car wheel will give him enough to think of, as will be seen from the specifications alone. In the machine shop, rolling mill and in the foundry itself, the mechanical engineer should be a master in adapting this metal, in its various forms, to the purpose in hand, and hence he cannot learn too much of the production of all classes of castings, gray, chilled, malleable and steel.

Finally there is the mining engineer, who has probably to suffer most from breakdowns with iron castings, as he is always isolated and must transport his repair parts great distances. He also should know something of foundry practise, as he could oftentimes help himself by "burning on" a broken piece, if he but knew how to rig up a temporary cupola out of an old boiler shell, and drive compressed air into the charge.

Some distance across the border down in Mexico, I saw a foundry which made it a business to cast repair parts for the various mines tributary to the city wherein it is located. This foundry used but little pig iron and much scrap; the scrap being inferior and the pig iron worse, the result is not to be wondered at, and hence it is the custom to send a duplicate order to the States for the same piece, which usually arrives just when the Mexican casting breaks. Had some of our young engineers in such regions knowledge of foundry metallurgy, they could take charge of the foundry for the time being and get creditable results, and the double expense and vexation would be avoided.

We take up first the pig irons, in the light of the specifications governing their purchase. We note that the charcoal irons form a special class by themselves. The cold, or moderately warm blast used, together with the more perfect reduction of the ore, produces an extremely sound and strong metal which cannot be always duplicated in the hot-blast coke process. This iron therefore goes into the highest grades of castings, and cannot well be covered by ordinary commercial specifications governing the great bulk of the pig iron made. Similarly the high silicon irons, and the ferro-silicons are a class by themselves. Being used only in very limited quantities, their impurities are not so important, so long as there is a great preponderance of silicon for mixing purposes.

Two cardinal requirements are laid down in specifying for pig irons: the content of silicon and of sulfur for the grade numbers known to commerce. These are as follows:

| Grade. | Silicon. | Sulfur. |
|---|---|---|
| No. 1 | 2.75 per cent. | 0.035 per cent. |
| No. 2 | 2.25 " | 0.045 " |
| No. 3 | 1.75 " | 0.055 " |
| No. 4 | 1.25 " | 0.065 " |

A clause is added to the specifications intended to take up the personal equation in sampling and in the analysis of the sample, a leeway of 10 per cent. being allowed in the silicon, and 0.01 in the sulfur that may be above the table figures. This variation may be doubled before the iron can be rejected, but a penalty is provided, thus reducing the cost to the buyer. While this penalty is small, yet it is only fair to the furnace man who has so many kinds of iron to pile up and care for, while the foundryman can always help himself with the iron he receives by judicious mixing. The better posted the foundryman is, the more liberal he will be with his pig-iron dealers. Personally, I have never rejected a carload of iron in my life of the several hundred thousand that have passed through my hands, but once in a while there have been heart to heart talks with the agents, resulting in concessions in price, and the iron was suitably mixed up and used. With these specifications and the assistance of a commercial laboratory, even the most back-number foundryman can get suitable iron for his castings, without relying upon the uncertain fracture appearance of a freshly broken pig, as he has done heretofore.

Perhaps the most important of the specifications from the standpoint of the engineer, is that for testing cast iron as a metal. This is the result of years of thought and experiment by engineers' and foundrymen's associations, as well as independent investigators, thoroughly digested

*Presented at the Indianapolis meeting, June, 1904, of the American Foundrymen's Association.

by those who were most active in this work, and the result approved by a majority of the cast-iron experts of the country. The following principles were recognized: In America we prefer to judge a casting which cannot be tested to destruction, by the quality of the iron entering into it. That is to say, by pouring the melted iron into test bars, under standard conditions, and then testing these bars to form conclusions therefrom. Next it is recognized that these bars should be made of as large a section as possible, consistent with a proper structure, or constitution of the iron, to avoid the artificial influences of damp molding sand, variations in pouring temperature, cooling strains, etc. Also to keep the tests within the limits of the ordinary testing machines found in our foundries.

Then comes the cross-section of the bars, the round form being better than the rectangular, as it avoids the artificial cooling at the corners. Next the manner of casting. Experience has shown that a bar cast flat, when tested in the position as cast gives different results from those obtained when the bar is reversed. Hence the importance of casting the bars vertical. The refinement of the bottom pour, tho giving better results, is too cumbersome for commercial use. A suitable rotation in the casting of these bars is necessary, so that the results may be representative. The bars are not to be tumbled, as this would remove casting strains, and make the material artificially strong when compared with the castings themselves, which are not so treated. Finally comes the testing of the bars themselves, which experience has shown to be best accomplished by placing them upon supports 12 inches apart and breaking by applying the load at the center. The deflection is also noted.

The best way to test castings is to take, say, three out of a batch of 103, all being made from the same heat and under the same conditions, and actually breaking them under as nearly service conditions as may be. For instance, the car wheel is now so tested in practise, not only by using the drop weight on it until shattered, thus giving the extreme of the pounding it would get in service, but by pouring around the chilled rim a stream of melted iron and noting the effect. Here again the extreme effect of the brake is applied to the wheel. If the three wheels thus treated will come up to expectations, the other 100 are accepted. Thus it will be seen how carefully material is looked over where life and property hang in the balance. In making boiler castings, every one of them should be subjected to the hydraulic test, and put under pressures at least 2½ times as great as the one to be kept up in actual service. If on going over the castings carefully during the test they stand up all right, they may be regarded as safe. Similarly a number of classes of other castings are tested under actual service conditions, with very good results.

The great bulk of castings, however, do not lend themselves to such tests, and hence it is necessary to pour bars to judge the iron as poured. The art of the founder should then insure the quality of the castings made to be as nearly that of the test bars. This, of course, is not always the case, but the buyer soon learns where he can get the best work suited to his requirements, and hence the incentive on the part of the founder to do the best possible for him. With a good iron as shown by the test bar, it is possible to make bad castings, but with a bad iron as shown by the test bar, it is not possible to get good castings. Hence our American method of giving the test bar the best chance possible, in order that one gets a correct idea of the situation, and can size up the founder's ability to do good work or his judgment in buying good or bad irons. There is nothing better than to have the foundry laboratory open to the free use of the inspector, so that he can see the shop tests before him all the time, whether for his work or that of the general run. This creates confidence, and invites suggestions for betterment all around.

One of the things the engineer should know is when and where to use cast iron. I have always felt that this material has no business in structures where life may be endangered in case of accident, other than in the ornamental portions. The cast-iron bridge member is now fortunately a relic of the olden times, and gradually cast iron has been replaced by steel where lightness and strength are objects. These tendencies can of course be carried too far, for there is no economy in using expensive steel construction in places where cast iron will do just as well. Wherever there is a quiescent load, which requires a material with high crushing strength to sustain it, there cast iron will be found most valuable. Wherever art work is to be added to the cold and bare constructions of the engineer, there cast iron is essential. The fact that last year some 3,600,000 tons of castings were made here shows what this industry means to our country.

I therefore commend the foundry to the engineer's most earnest attention, as he can hardly turn about in his professional work without coming into contact with its products. With the excellent literature now available in this branch of the arts, with a progressive technical press and the welcome he will get in visiting foundries, there is no reason why an engineer should not be well posted on cast iron and thus make experience serve him all the better in the daily problems of his profession.

---

It has been recently claimed by German physicians that rheumatism may be cured by the water used in granulating iron blast furnace slag.

## Letters From Practical Men.

**The Value to Inventors of Being Able to Draw.**

Editor American Machinist:

At page 21 there is an interesting article on the above subject by Professor Amasa Trowbridge. Most people look upon the ability to draw (I mean by this free-hand drawing) as a special gift of the gods. This view I think is wrong, and while heredity and prenatal influence no doubt play an important part, still environment directs to a great extent the trend of a child's amusements, and if we can incline the child to take up pastimes which will in the future possibly be of practical value we have surely gained much. In doing this we must extract as little of the play element as possible.

I have three boys ranging in age from six to fifteen years. As soon as each was old enough (about two years) he was given all the paper and pencils he could use (but not abuse) and the kindly criticism of both father and mother, credit given for work that was good and a small cash prize for anything exceptionally good, the faults being pointed out and the youthful artist shown how to overcome them. This is of value even if the knowledge thus gained is used to *read* drawings only, for by this the eyes are trained to detect details and value them according to their importance.

I may mention that our machine shops contain many men who cannot read a mechanical drawing, and many men who can are incapable of making a rough sketch to illustrate a motion which has definite shape in their brains only.

Of course one child will show more aptitude than another; with my own boys this is the case, the second one having considerably more ability, taking the difference of age into consideration, than the older boy.

My second boy was with me one evening at the office of a friend (whom I had, with the pardonable pride of a fond father previously told of his ability to draw). This gentleman asked him to draw something. It was late in the evening and chilly; a small gas stove was lit, and standing in the center of the room. This was selected by my friend as a model. The little boy (he was then about six) drew the stove and tubing and then asked for a *red* pencil to make the light rays which shone through the mica windows. My friend was so pleased that he gave Lou a lot of pencils and paper and a new quarter.

Some weeks after this the older boy was teasing the younger one and, childlike, was bragging about his possessions to the belittlement of those of his brother. The little fellow stood it as long he could and then burst out with "You may have a printing press, and a yacht, and a steam engine, but I have these," holding up two chubby fists, "and as long as I have a pencil and a piece of paper I can earn a quarter and buy anything I want."

Another little yarn and I finish. Years ago when I was at sea, on my first voyage up the Rio de la Plata in the Argentine Republic, San Lorenzo was our first stop, tho involuntarily on our part, for, the river being low, we ran up high and dry on the bar. No one except a seafaring man can appreciate the peculiar cravings that men have after a long voyage. Some desire one thing and some another. My particular fancy was for some new milk, so I pulled ashore in one of the boats, and on my way to a farm I overtook two girls. My knowledge of Spanish in those days was very meagre; I could understand quite well, but could not speak it. As I approached the girls I tried to remember what the Spanish for milk was, but without success. So I tried them with French, which I spoke well, and thought that, as French and Spanish are both romance languages, the similarity might be sufficient for the girls to understand me. They, however, shook their heads; then I tried them with Latin, of which I have a smattering, with like result.

As a last resort, I took out my pencil and note-book and sketched what I thought was a very dignified matronly looking old cow with a full complement of horns and teats. There was a stream of milk gushing from one teat into a cup. I handed the result of my efforts to one of the girls, who showed it to the other. The first one evidently did not understand it at all, but the second one, with a great show of enthusiasm, exclaimed "Que lindo perro!" ("What a beautiful dog!")

Now, if those girls had had any training in drawing at all they would have known that even an impressionist does not put horns on a portrait of a dog.

Up at the farm I had better success, and got the milk I craved. DIXIE.

### Checking Tools taken From Toolroom.

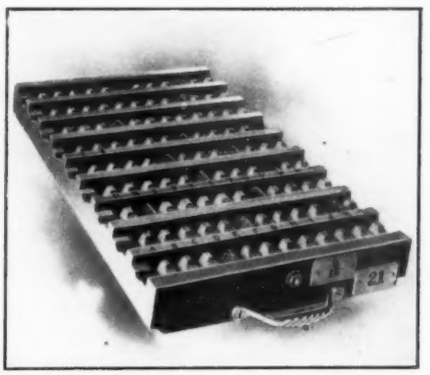
Editor American Machinist:

I find that the question of how to take care of the checks that are left in place of the tools in the toolroom is a serious matter, and also one that is too often neglected, to the detriment of the service. On the smallest tools the checks take up as much room as the tools. Usually, the taking care of the checks is an afterthought, and no provision is made for it in *designing* (?) the tool cases, as you can "hang up a check any old place." In my first toolroom the checks were hung up on six-penny finishing nails, and in the course of the day several would find their way to the floor, and the boy's guesses as to where they came from caused many disputes at the window. At my next place I had ¾-inch brass cup hooks, which were a great improvement, but were not what should be. At the present time I am getting rid of the hooks, as I have something very much better, as illustrated in the photographs herewith.

DRILL CABINET AND CHECK DRAWERS.

The drill case is made for 100 drills of each size from ¼ inch to 1 7-32 inches, inclusive, advancing by thirty-seconds. The case is 6 feet long outside, 57 inches high, 22 inches wide at the bottom and 14 inches wide at the top. The drills ¼ to 23-32 inch are in drawers, and the ¾ to 1 7-32 inch are in pockets, as 100 of the larger drills would make too much of a load for the drawers, and plenty of space can be left for the hand to take out the larger drills without waste of room.

In order to give an equal number of drills to each drawer or space, the spaces increase in width from left to right, the left-hand column of drawers and spaces



A CHECK DRAWER.

being 13½ inches wide and the right-hand column being 15 inches wide. The column of drawers in the center, 8 inches wide, is for the checks—one drawer for each size of drill, so that there is no excuse for getting checks in the wrong place.

Each check drawer will hold 108 checks, one check in a pocket, and in such position that the check number can be conveniently read without disturbing the check. The photograph of single drawer shows this quite well, the drawer being made up of alternate check strips 1 inch wide and plain strips about ⅜ or ½ inch thick.

Now, to explain matters a little, each drill has an individual mark, and also each check pocket has an individual mark, the drills being lettered, as, for instance, the 9-16 inch drills are marked 9/16-A, 9/16-B, etc., until the alphabet is used up; then, as more are needed, we mark the next twenty-six 9/16-A*, 9/16-B*, etc., the star mark after the letter making it very plain to which alphabet it belongs. In the photograph of the drawer you will notice a row of letters between the first and second rows of check-pockets, the letters naming the pockets, the row in front of the letter being plain A, B, etc., the row behind being A*, B*, etc. The same method is continued between the third and fourth rows, etc.

Round checks will work all right in these pockets, but the best check is a square one with rounded corners. The check number being at the bottom makes it more convenient in many respects than the round one with the number in the center. The number on the check in the photograph is 3066. The front of the drawer has two numbers on it; 9/16" = size of drill it belongs to, 21 being the number of the check drawer and also of the drill drawer, which is marked with duplicates of these plates; the mark being at the right of the handle shows that 9/16 drills

will be found at the right of the center of the case.

The drill drawers at the left of center are numbered from 1 to 16, those at the right of center from 17 to 32, the check drawers being numbered from the top 1, 2, 17, 18, 3, 4, 19, 20, etc., that the check drawer may be as near as possible in line with the drill drawer.

This case has been in use now for over six months, and is in all respects a great improvement over any that we've had before for the same purpose.

CHAS. W. WRIGHT.

### Designing Ball Bearings.

Editor American Machinist:

A few days ago I was asked to design some ball bearings. Having remembered seeing an article on the point in the AMERICAN MACHINIST, I looked and succeeded in finding it at pages 1592 and 1593, Vol. 26, by P. S. Bushnell.

I applied the diagram given to the bearings I had in question, but found it was practically useless, as the result was not near enough, being only sure of obtaining the correct answer to one place of decimal, which is not sufficient for ball bearings.

There were also three other things I noticed:

First—In the formula your correspondent has

$$D = \frac{d + l}{\sin. \frac{180°}{N}}$$

which I think ought to read

$$D_1 = \frac{d + l}{\sin. \frac{180°}{N}}$$

| Number of Balls. | SIZE OF BALLS. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1″ | 7/8″ | 3/4″ | 5/8″ | 1/2″ | 7/16″ | 3/8″ | 5/16″ | 1/4″ | 3/16″ |
| 8 | 2.612 | 2.286 | 1.959 | 1.633 | 1.306 | 1.143 | .980 | .817 | .653 | .490 |
| | 2.625 | 2 299 | 1.972 | 1.646 | 1.319 | 1.156 | .993 | .830 | .666 | .503 |
| 9 | 2 923 | 2.558 | 2.192 | 1.827 | 1.462 | 1.279 | 1.096 | .914 | .731 | .548 |
| | 2 937 | 2.572 | 2.206 | 1.841 | 1.476 | 1.293 | 1.110 | .928 | .745 | .562 |
| 10 | 3 236 | 2.832 | 2.427 | 2.023 | 1 618 | 1.416 | 1.214 | 1.012 | .809 | .607 |
| | 3.252 | 2.845 | 2.443 | 2.039 | 1.634 | 1.432 | 1.230 | 1.028 | .825 | .623 |
| 11 | 3.548 | 3.105 | 2 661 | 2.218 | 1.774 | 1.552 | 1 331 | 1.109 | .887 | .665 |
| | 3.566 | 3.123 | 2.679 | 2.236 | 1.792 | 1 570 | 1.349 | 1.127 | .905 | .683 |
| 12 | 3.864 | 3 381 | 2.898 | 2.415 | 1.932 | 1.691 | 1.449 | 1.208 | .966 | .725 |
| | 3.883 | 3.400 | 2 917 | 2 434 | 1.951 | 1.710 | 1.468 | 1.227 | .985 | 744 |
| 13 | 4.179 | 3.657 | 3.134 | 2.612 | 1.090 | 1.829 | 1.567 | 1.306 | 1.045 | .784 |
| | 4.200 | 3.678 | 3 155 | 2 633 | 2.111 | 1.850 | 1.588 | 1.327 | 1.066 | .805 |
| 14 | 4.494 | 3 932 | 3 371 | 2.809 | 2.247 | 1.966 | 1.685 | 1.405 | 1.124 | .843 |
| | 4.517 | 3 955 | 3.394 | 2.832 | 2.270 | 1.989 | 1.708 | 1.428 | 1.147 | .866 |
| 15 | 4.810 | 4.209 | 3.608 | 3.007 | 2.405 | 2.105 | 1 804 | 1.504 | 1.203 | .902 |
| | 4.834 | 4 233 | 3 632 | 3.031 | 2.429 | 2.129 | 1 828 | 1.528 | 1.227 | .926 |
| 16 | 5.125 | 4.485 | 3.844 | 3.203 | 2 563 | 2.242 | 1.922 | 1.602 | 1.281 | .961 |
| | 5.151 | 4.511 | 3.870 | 3.229 | 2.589 | 2.268 | 1.948 | 1.628 | 1 307 | .987 |
| 17 | 5.440 | 4.760 | 4.080 | 3.400 | 2.720 | 2.380 | 2.040 | 1.700 | 1.360 | 1.020 |
| | 5.467 | 4 787 | 4.107 | 3.427 | 2.747 | 2.407 | 2.067 | 1.727 | 1.387 | 1 047 |
| 18 | 5.758 | 5.038 | 4.319 | 3.599 | 2.879 | 2.519 | 2.159 | 1 800 | 1.440 | 1.080 |
| | 5.787 | 5.067 | 4.348 | 3.628 | 2.908 | 2.548 | 2.188 | 1.829 | 1.469 | 1.109 |
| 19 | 6.075 | 5.316 | 4.556 | 3.797 | 3.038 | 2.658 | 2.278 | 1.899 | 1.519 | 1.139 |
| | 6.105 | 5.346 | 4 586 | 3 827 | 3.068 | 2.688 | 2 308 | 1.929 | 1.549 | 1.169 |
| 20 | 6.394 | 5 595 | 4 795 | 3 997 | 3 197 | 2 798 | 2 398 | 1.998 | 1 599 | 1.199 |
| | 6.426 | 5.627 | 4.827 | 4 029 | 3.229 | 2.830 | 2.430 | 2.030 | 1.631 | 1.231 |
| 21 | 6.710 | 5.871 | 5.033 | 4.194 | 3.355 | 2 936 | 2.516 | 2 097 | 1.678 | 1.258 |
| | 6.743 | 5.904 | 5.066 | 4.227 | 3.388 | 2 969 | 2.549 | 2.130 | 1.711 | 1.291 |
| 22 | 7.027 | 6.149 | 5.270 | 4 392 | 3 514 | 3.075 | 2.635 | 2.196 | 1.757 | 1.318 |
| | 7.062 | 6.184 | 5.305 | 4.427 | 3.549 | 3 110 | 2.670 | 2.231 | 1.792 | 1.353 |
| 23 | 7.345 | 6 427 | 5 509 | 4.590 | 3.673 | 3.213 | 2.754 | 2.295 | 1.836 | 1.377 |
| | 7.381 | 6.463 | 5.545 | 4 626 | 3.709 | 3 249 | 2.790 | 2.331 | 1.872 | 1.413 |
| 24 | 7.662 | 6.704 | 5.747 | 4.789 | 3.831 | 3.352 | 2.873 | 2.394 | 1.9 6 | 1.437 |
| | 7.700 | 6.742 | 5.785 | 4 827 | 3.869 | 3 390 | 2.911 | 2.432 | 1.954 | 1.475 |
| 25 | 7.978 | 6.981 | 5 984 | 4 987 | 3 989 | 3.491 | 2.992 | 2.493 | 1.995 | 1.496 |
| | 8 017 | 7.020 | 6.023 | 5 026 | 4 028 | 3 530 | 3 031 | 2.532 | 2.034 | 1.535 |

Second—In the example given, the reading from the diagram is somewhat about 1.89, and could not possibly be located exactly; but it was given in the text as 1.93—a proof of the inefficiency of the diagram.

Third—In the formula there is given $l$ = clearance between balls, but no approximate allowance for same, which I think is a most deplorable oversight, as the clearance is a very important item.

Having the above state of things in mind, I commenced the table I have given, which I think will prove useful to some of your readers, and is based on the following formula:

$$D = \frac{d + l}{\sin. \frac{180°}{N}}$$

in which

$D$ = diameter of ball circle,
$d$ = diameter of ball,
$l$ = clearance between balls,
$N$ = number of balls.

$D$ is the diameter of the circle passing through the ball centers.

$l$ = .005 inch in all ordinary circumstances; but when $N \times .005$ inch is greater than $\frac{1}{4} d$, $l = \frac{\frac{1}{4} d}{N}$

In reference to the table, it will be seen that there are two lines of figures. The first is the diameter of the ball circle, not allowing for clearance, and the second is the diameter of the ball circle, allowing clearance to the above rule.

The reason for this is that anyone can add any special clearance for the balls they desire to the first line of figures, without having to work from the formula.

SAFFAS.

### A Method of Marking Negatives.

Editor American Machinist:

I noticed at page 800 an inquiry for a method of marking negatives and, having had quite a little experience in commercial photography, I will give the method practised in my work.

The originator of the method is unknown to me, but it is very simple and consists in the use of a piece of thin celluloid similar to that used in the ordinary film camera—in fact, a piece of spoiled film may be used with good results if the emulsion has been entirely removed, leaving the film perfectly clean and transparent. The method consists simply in making any lettering or inscription on this celluloid desired, using any good drawing ink with an ordinary steel pen. I fasten the celluloid to the drawing-board with thumb tacks and write thereon the title desired; if desired, any design or lettering may be placed underneath the celluloid and traced thereon. I use a piece of celluloid the full size of my negatives for most of my work; however, a very small piece only large enough to contain the inscription may be used, placing it on any convenient part of the negative, but in using a small piece the edges of it will sometimes show on the negative. The method of using this kink is simply placing the properly lettered piece of celluloid between the negative and the printing paper, the

use of which will obtain very pleasing results.

After the lettering has been used it may be removed with a damp sponge or cloth, and the celluloid is ready for the next inscription. E. S. SHEPERD.

### A Milling Fixture and a Drill Jig.

Editor American Machinist:

Having found this index milling fixture to be very convenient and simple in its construction, I thought it worth while illustrating it in the AMERICAN MACHINIST. Its operation is to mill on one end of a brass cylinder 23 steps, half the circle of the cylinder ¼ inch apart; different diameters had to be milled in this fixture, and they had to be very true when turning around.

The fixture proper, *a*, is made of gray iron with two slots *o* on each side, so that it can be bolted securely on to the table. On top is fastened the index-pin plate *b* with two screws and two dowel pins; in this is screwed the index sleeve *c*; this holds the index pin *d*, with a spiral spring to hold the pin down when in position in the hole. The pin is tapered on the point to compensate for wear. Down below the

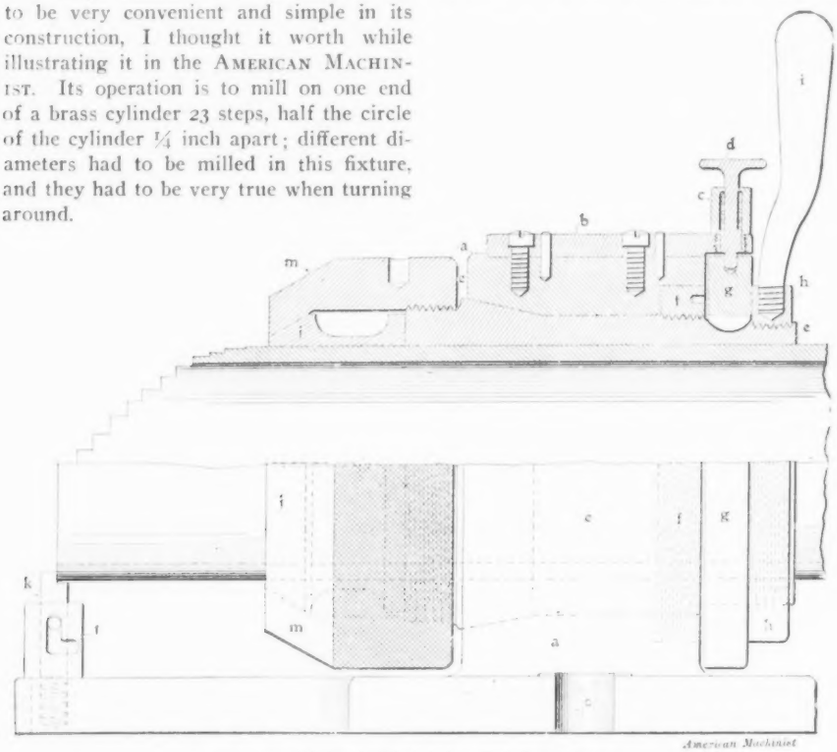



FIG. 1. INDEX MILLING MACHINE FIXTURE.

Before the milling operation, the drill jig, Fig. 2, is placed on the end of the cylinder to be milled, and 23 holes are drilled in a pyramid shape. This is done by placing the milling fixture on the drill-press platen. The extension of the fixture plate serves as a stop for the milling operation, and to prevent the fixture from tipping when drilling. After the cylinder has been drilled, the pyramid shaped part is broken off by a light rap with a hammer, the remaining part of the cylinder is now shaped and roughed out, so one cut of an end mill will finish it to the proper shape.

The milling operation is done on a hand miller. The cross-slide screw is cut to one turn in ½ inch by having it double thread. Two spring stops (similar to the one on the milling fixture) are screwed on the handle; with a half turn of the handle the work moves forward ¼ inch. A hand miller enables the operator to return the work very quickly; the cut is started down at the bottom of the cylinder, when the cutter is on the center of the fixture. Having securely locked the slide with two stops on either side of the horizontal slide, then indexing one on each side of the first cut same time as it is moved forward. The details of the fixture are as follows:

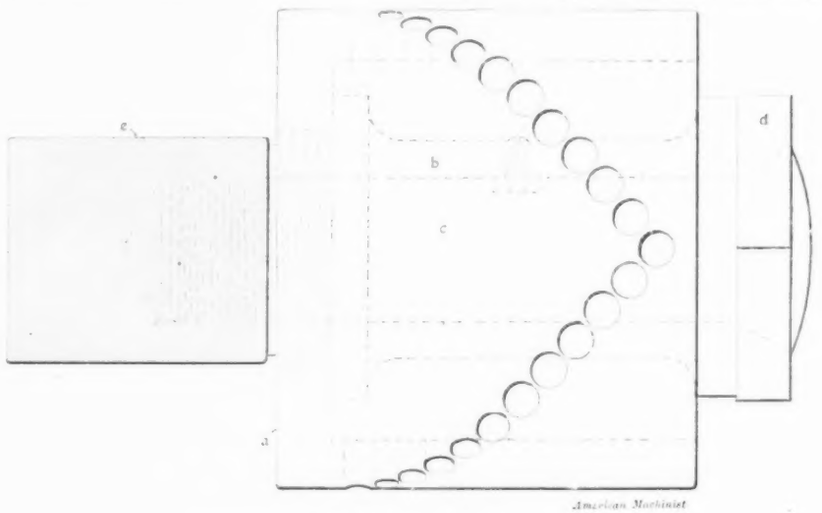



FIG. 2. DRILL JIG.

front is extended 3 inches; the stop-pin bushing *l* is driven in tight, the stop pin *k* has a pin handle driven in it and a spiral spring below it, to force it up when in operation. The center of the fixture is bored to fit the spindle and the nut.

The spindle *e* is made of machinery steel, faced off square on the front, with a nut *f* in the middle drawn up to a shoulder with a spanner wrench fitted in the two holes on the side, to keep the spindle a turning fit and to compensate for wear. In the rear of this nut is keyed the index wheel *g* which has 23 holes an equal distance apart on top half of circle only. These holes are numbered from 1 to 11 on either side of the center hole *o*. When the bottom cut is made the index pin is in hole No. 0 and the fixture raised with cutter in the center; now index it to No. 1 on the left-hand side, same time move the cross-slide handle a half turn. The fixture now is lowered while a cut is taken. Now move the index wheel till pin enters No. 1 hole on right side and go down with the cutter till finished. Repeat the same operation with the remaining steps. The index wheel is made of mild steel and case-hardened; the index holes are tapered to correspond with the index pin to compensate for wear. Back of the index wheel is a check-nut *h* with a handle *i* screwed into it to be used when turning the spindle.

In front of the spindle is a split loose collet *j*. This can easily be removed to be exchanged for any size hole desired. On the spindle is screwed the cap *m* which is knurled on the outside with a hole for a spanner wrench; inside it fits the front of the collet; when drawn in it forces the collet against the face of the spindle and holds the work securely.

Fig. 2 shows the assembled drill jig. This is constructed so as the burr will not interfere with the jig when work is taken out after drilling operation. The cup *a* is made of tool steel and pack hardened, as the holes are so close together it would not be practical to have drill bushings in them. The cup is bored .020 inch larger than the outside diameter of the cylinder shown in the fixture; in the center it is bored out and tapped in the same setting to fit the extension *b*; this is made of mild steel. On the outer end it is turned .020 inch smaller than the inside diameter of the hole in the cylinder, but the inner end is a turning fit so as the drill jig will come central, and is threaded to fit the

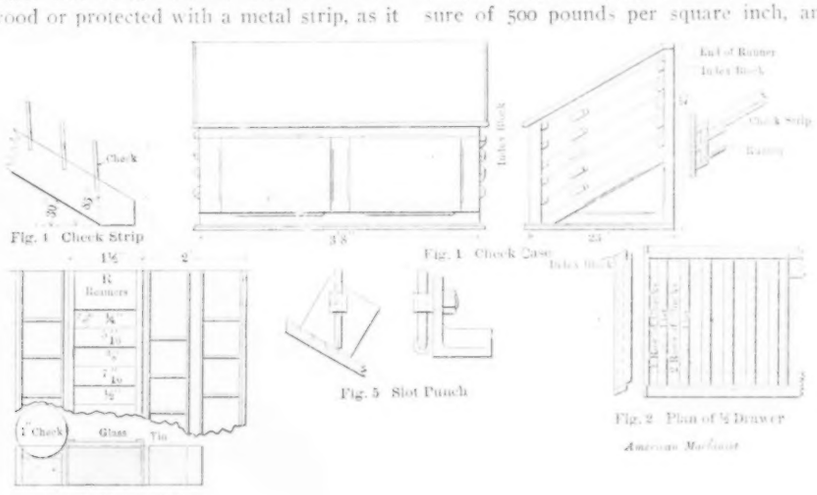
cup. The center is bored to receive the draw-in screw *c;* on this is placed the split spring *d*, with a taper hole in the center to fit the ring; when drawn out by the knurled hand nut *e* it expands and holds the jig securely while the drilling operation is performed. A. L. MONRAD.

### A Toolroom Check Case.

Editor American Machinist:

I used for four years at the Trade School, Hampton Institute, a check board for my toolroom that I found to be very satisfactory. It may be old, but I never have seen another like it, and had intended to describe it before this, but have not been able to secure a photograph since leaving the place.

The first board was set at an angle of 30 degrees and the holes punched in it with a punch made as shown in Fig. 5. The space occupied and its collection of dust suggested an improvement which I will describe: Fig. 1 shows the front and side views of a case built with the drawers on an angle of 30 degrees and with a pull on each end, so they can be drawn to the center each way. The construction and arrangement of the drawer is shown in Fig. 2, and an arrangement of the lists and check slots in Fig. 3. Fig. 4 shows the angle of the checks when in place. The lists are written out on paper and are protected by the strip of glass as shown in section in Fig. 3. The slots can be cut in a wide piece on a small circular saw or in a miter box, then sawed to width and the thin strips glued and nailed on. The list and check pieces should not be fastened together; they lie in the drawer so they can be easily rearranged. The lower side of the drawer should be hardwood or protected with a metal strip, as it




A TOOLROOM CHECK CASE.

must run very smoothly. A few rollers would be a great help. The index block on each end of the drawer shows what it contains. The case should stand out in the room and the top drawer should be 3½ to 4 feet high.

Of the three systems of keeping checks with which I am familiar, the first hangs its checks on a board opposite a list; the second puts the checks in the place of the tool; the third is described in the AMERICAN MACHINIST, at page 260, 1901, and a similar system at page 757 of the same year. The case and method of keeping the checks shown in this article belong to the first system. One of the merits of any system is condensation. This case, with drawers 22 inches wide, 50 checks in a row, will hold 3,000 checks. If 3,000 checks are not enough, put five more drawers at the back and slanting in the opposite direction. Another very desirable feature is ease of manipulation. Certainly one cannot hang on or remove a check from a nail or hook as easily or quickly as it can be placed in, or removed from the slot. This system has two points in its favor—First, you do not need to look the whole toolroom over to find out what tools are out; a glance at the board shows that, and who has them. Second, your lists are a perpetual inventory and can be added to without re-writing the whole thing. Of the three systems I consider the first the only one that should be used in school work where the students issue the tools, for this makes it necessary for them to learn the names of the tools.

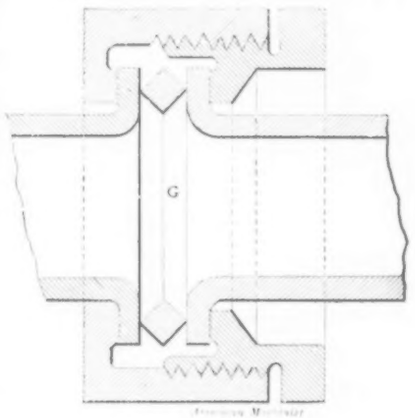
The merits of a checking system is not the object of this article, but a method of keeping the checks, and the case is shown for a very large number of tools. I would be glad to know if anyone has a more compact system. W. H. PARKER.

State College, Pa.

### An Experimental Joint.

Editor American Machinist:

In the course of some experiments with a flash boiler carrying a maximum pressure of 500 pounds per square inch, and using vaporized oil as a fuel, much inconvenience was experienced by leakage of joints. Several methods were tried, different joints purchased in the open market, but the excesive heat and pressure proved their inefficiency, and it was finally decided to experiment on the line of joints until success or absolute failure was achieved. The joints already used were reconstructed, copper wire gaskets introduced, so-called rubber gaskets tried, and finally, after spending a considerable amount of time and money, the joint illustrated below was adopted. This has proved very satisfactory, stood up well under both the high pressure and the excessive heat




AN EXPERIMENTAL JOINT.

accompanied thereby, and stood a cold-water test of 1,000 pounds per square inch.

As a few of these points were directly exposed to the fire, and must have been heated to a far higher temperature than the heat corresponding to the pressure carried, the successful maintenance of a tight joint in this location was a matter of no small moment.

The illustration shows this joint, or union, in section which is full size for a joint made on 1-inch steel tubing—12 B. W. G. Either end of the tube is upset at right angles to its axis by heating with a blowpipe or other suitable apparatus, and these faces surfaced by filing. The copper gasket *G* was made in the lathe from a piece of seamless drawn copper tubing, is of a diamond section, and has a face of about .015 inch, which comes in contact with the flanged ends of the tube. The male and female portions of the union are preferably made of steel, and experience seemed to point to the threaded portions being cut 12 threads per inch.

In operation the joint was made up cold, tested to 1,000 pounds per square inch by hydraulic pressure in its place in the boiler, fire was started and steam pressure brought to the maximum of 500 pounds per square inch. Upon the boiler cooling, the hydraulic test was again made, and failed to show any leakage of the unions.

It was a matter of some doubt as to the effect the linear expansion would have on the joint; the temperature being very high when under working conditions and dropping to that of the surrounding atmosphere when the boiler was out of use, but no leakage occurred. While the expense is somewhat higher than the commercial union, the results obtained justified the added expense. V. A. H.

### A Drilling Jig and a Special Job of Countersinking.

Editor American Machinist:

The piece to be operated on is a composition casting shown in Fig. 1 and is used as part of a diving lamp.

After being finished all over, as required on the detail, it is clamped in the drilling jig, the construction of which is clearly shown in the three views of Fig. 2. Top

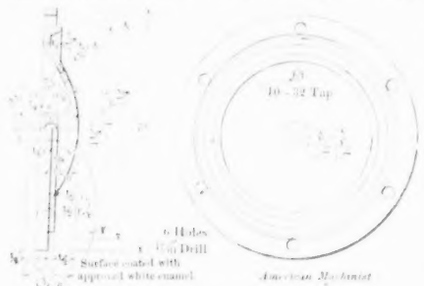



FIG. 1. THE PIECE TO BE FINISHED.

$T$ is made of a block of machine steel, one side shaped to conform with the inside of the piece to be drilled, allowing clearance for the curved surface as shown in the sectional view. An end mill is used for making the cut to each side of the hole $X$, and a counterbore to make the cut to hole $Y$. The clamping plate $P$ is hinged to two of the legs with pin $H$ and is tightened up with the thumb-screw $S$.

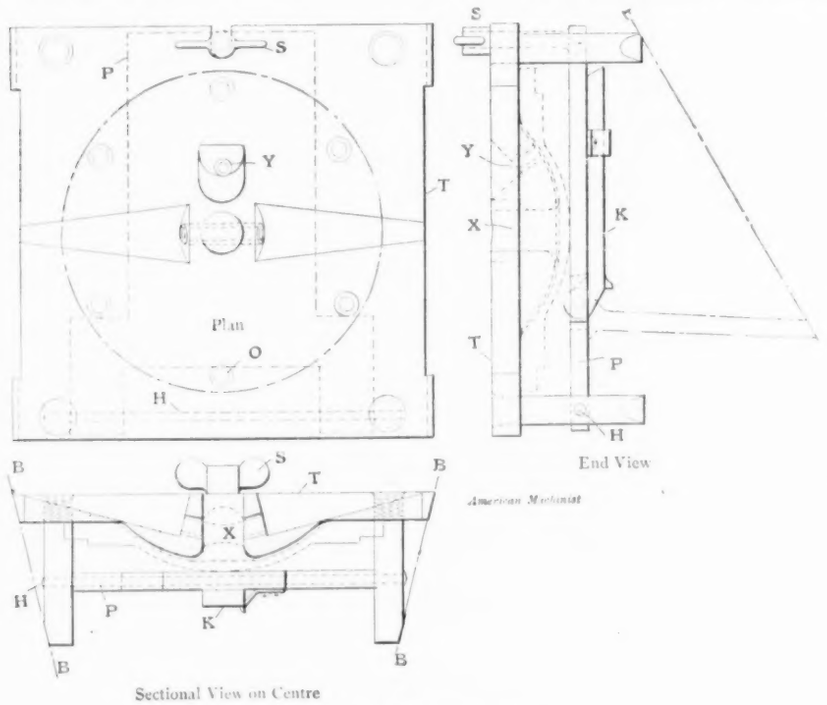



FIG. 2. THE DRILLING JIG.

After the six outside holes $O$ are drilled, the hinged arm $K$ is swung out, stopping at the position shown in the end view and with base line $B\,B$ representing the table of the drill press, the hole $Y$ is drilled.

For the last drilling operation the jig stands in the position indicated by the base lines $B\,B$ in the sectional view and the hole $X$ is drilled from both sides.

This hole must be finished by hand, which is accomplished with the tool, Fig. 3. Tool-steel cutters $S$ and $S'$ are hardened and inserted in the pliers, as shown. Each has four cutting edges standing alternately, indicated in view 2, the shape of the cutting edges being the required shape of the hole. The tool $S'$ is made with tapered front face, to hog out the material left at the top of the hole, seen in Fig. 4.

By rubbing lightly over the cutting edges with an oilstone, a smooth finished surface is obtained.

The pliers are worked through two-fifths of a revolution on one side, then changed and tool $S'$ worked from other side.

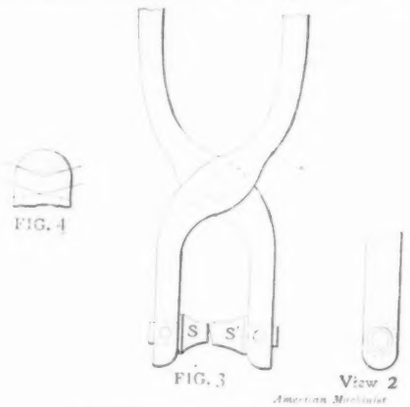
HENRY SCHEISS.

Brooklyn.

### Terence Moriarity & Co.

Editor American Machinist:

It was away back in the panic year, 1893. I had been in desperate straits for many weeks; my last job was as toolmaker and general all-round handy-man in a large bicycle repair shop; but trade began to fall off, and the boss, being of a devout turn of mind, scanned his books and, seeing that I was the *last* to be employed, piously resolved that I should be the *first* to go. Oh, how disheartening were those weary trudges from shop to shop, only to be turned down! At length, one evening, heartily sick of it all and thoroughly determined to go to sea again (where I could at least make a living), our doctor came in and told me he knew of a job in the bicycle business, where I could get $10 a week to start and a rise if things went all right. I jumped at the offer, went with him at once, and was introduced by him to his cousin, Mr. Ryan (who was the company in the above firm). Mr. Ryan was a traveling salesman, with a very considerable idea of his own importance and astuteness. He was ready at all times to impart useless information to anyone who could not escape him. He had borrowed a thousand dollars from an over-trusting mother and had invested it in several fourth-hand tools, at the instigation of Mr. Moriarity, who had been an eminently successful failure as a locksmith; and at the time when I broke in on their lives, Mr. Moriarity was about to repeat his former success, but this time in the "bise-ikle" (as he pronounced it) business.




FINISHING TOOL FOR HOLES.

So I was engaged by Ryan as a sort of forlorn hope, to save the fragments of his shattered thousand dollars and patch together the remnants of his shivered self-esteem; for Ryan, the prophet of success, dare not fail.

The next morning I, overalls in hand, hied me to the factory of Terence Moriarity & Co. Mr. Moriarity met me at the door, and after I had introduced myself, he began to catechise me.

"Well, young maan, an' phaat do youse know about bise-ikles?"

"Oh, a little," I modestly replied. "Yes, domd little, Oi bet. Phwat do yez know about fasforus bronze?" "Phosphor bronze is an alloy of brass and is said to have about the same tensile strength as mild steel." "You're roight. Oi suppose ye onderstahnd that th' wurrd *tinsile* manes that ut's as harrd as tool stale." I admitted that I understood it meant that, but that now I could state it on authority, having heard it from him.

"You just kape a civul tongue in yure head, and if yure not too darned dumb Oi'll larn yez lots o' things. Now, if there's annything yez don't know, just ask me and Oi'll tell yez."

So I was taken into the shop and given a lot of phosphor bronze front and rear hubs to bore out. The castings looked as if the molder had made the mold with his thumb; the cores were all badly out of center. I chucked the first one and, having forged a boring tool and flat drill, I began to true the hole before putting the flat drill through (which was to pre-

cede a reamer). The first cut was about half way through and the hole was nowhere near true yet, when Mr. Moriarty stepped over: "Uts a long toime ye're takin'; phwat koind o' domd nonsinse is thus? put a twish drill tro' ut." "But," said I, "the hole is too far out of true." "Out o' true, is ut? Don't let me hear ye questionizin' th' wurrk o' yure betthers, young maan; Oi made th' patterns for thim hubs. Here," he said, picking out a 9-16 twist drill, "put thot troo." "Will you kindly grind it for me, Mr. Moriarty? You see, I've had very little experience with phosphor bronze and I would like you to show me the correct angle and clearance to give the drill." (What I really wanted to see was whether he knew enough to put a little flat on the cutting lips to prevent the drill pulling in.) He was childishly delighted with my deference to his superior knowledge, and as I stood beside him at the emery wheel he went through no end of funny antics; at last he had a drill that would have done good service in soft white pine. "Now, Mr. Moriarity, if you will drill the first one I think I can do the rest afterwards." "Roight ye are, young man, Oi'll larn ye. Just take th' cinter out o' th' tailstock and put th' drill chuck in instid." As I took the center out I noted that there was about 5/8 inch of lost motion endways in the tail spindle. "Now droive th' chuck in harrd wid a hammer," said he. I began to do a little quick thinking at this point. A bronze hub with a cored hole in it gripped tight in a four-jaw independent chuck, a drill ground correctly for wood and securely held in a chuck driven into the tail spindle with a sledge, and a tail spindle with 5/8 inch of end play, are rather a bad combination when it comes to drilling that hub with that drill.

I was too young to die, and then I was also entirely unprepared, so having made everything tight and fast I sneaked behind the headstock in line with the spindle (the spindle was solid, so I had no fear of a stray shot through it) and waited for things to occur.

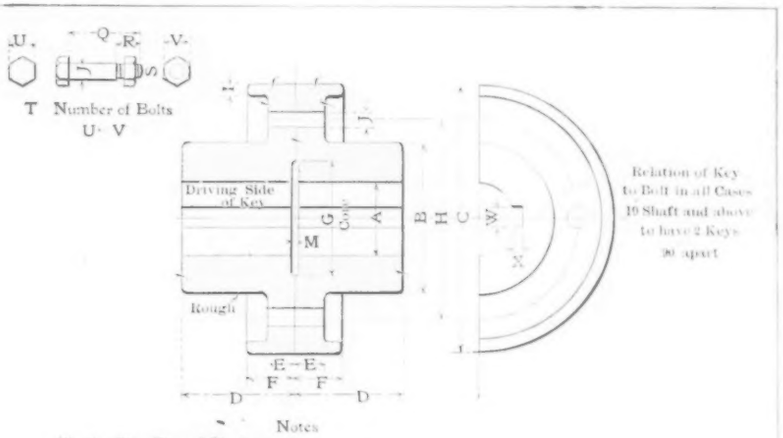
Mr. Moriarity in the meantime had shifted the belt to the highest speed; he then began to feed the drill into the cored hole in the hub (I use the word *began* advisedly, for that was all he did do). The moment the lips of the drill touched the edge of the hole, that 5/8 inch of slack in the tail spindle did its own feeding, the drill was broken off short, but not before it had jerked the hub out of the chuck, and as Mr. Moriarity happened to be directly in the orbit of the hub, it caught him just below the belt and Terence Moriarity was down and out. "Do you want them all done that way, Mr. Moriarity? If so, I think a conning tower of Krupp steel would be an advantage." "Yez betther git on wid yer worrk and don't poke no fun at yure shuperiors, young maan."

DIXIE.

## A Standard Flanged Shaft Coupling.

Editor American Machinist:

The flanged coupling here shown, altho primarily designed for rolling-mill work, in which the strains are most severe, is well adapted to general work for nearly all cases in which extreme economy of material is unnecessary and durability is important. In designing this coupling I had at hand for comparison the tables of dimensions of Fraser & Chalmers, the Dodge Manufacturing Company, the Webster Manufacturing Company, Jones & Laughlins, the Scranton Correspondence School, one from the AMERICAN MACHINIST, and several others. Three or four of these tables had many irregularities and the couplings had evidently been designed one at a time as the business grew, with no regular method. Some of them were absurdly heavy and some light. The best table, which had evidently been made from a diagram, showed couplings which were, in our judgment, too light for extreme duty. Two of the tables used bolts much larger and fewer in number than the usual practise, particularly in the larger sizes of couplings. Altho this coupling is slightly heavier, perhaps, than the average coupling now on the market, there are several sizes of some of the irregular couplings I have mentioned that weigh more than the corresponding size in this table. A diagram was carefully laid out, using only straight lines and the nearest convenient size used wherever the diagram indicated a fraction. Altho relatively small numbers of large bolts are used on one or two of the smallest sizes the figures in general correspond very nearly with a diagram using straight lines.


U
Q
R
V
T Number of Bolts
U V
Driving Side of Key
Rough
Relation of Key to Bolt in all Cases
19 Shaft and above to have 2 Keys 180 apart
Notes
(1) A Fin. Dia. of Shaft
(2) Coupling to be Pressed Fit on Shaft. Special Case hard Fit
(3) Taper of Keys 3/32" to 1'

| A | B | C | D | E | F | G | H | J | L | M | Q | R | S | T | Key W | Key X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1" | 2" | 5 3/8" | 1 9/16" | 9/16" | 1 1/4" | 1 1/2" | 3 1/2" | 5/16" | 1/4" | 1/8" | 1 1/4" | 11/16 | 1/2 | 4" | 1/4" | 3/16" |
| 1 1/4 | 2 1/4 | 6 1/2 | 1 3/4 | 11/16 | 1 5/8 | 1 5/8 | 4 1/2 | 3/8 | 5/16 | 1/8 | 2 | 11/16 | 1/2 | 4 | 5/16 | 1/32 |
| 1 1/2 | 3 | 7 | 2 1/4 | 3/4 | 1 15/16 | 2 1/4 | 4 13/16 | 3/8 | 5/16 | 1/8 | 2 1/2 | 11/16 | 1/2 | 4 | 3/8 | 3/16 |
| 1 3/4 | 3 1/2 | 7 3/4 | 2 3/8 | 3/4 | 1 11/16 | 2 3/8 | 5 1/4 | 11/16 | 3/8 | 1/8 | 2 1/2 | 3/4 | 3/8 | 5 | 1/2 | 1/4 |
| 2 | 4 | 8 1/2 | 3 | 3/4 | 1 11/16 | 3 | 5 1/2 | 11/16 | 3/8 | 1/8 | 2 1/2 | 3/4 | 3/8 | 5 | 1/2 | 1/4 |
| 2 1/4 | 4 1/2 | 9 1/8 | 3 3/8 | 1 | 1 13/16 | 3 3/8 | 6 1/8 | 3/4 | 5/16 | 1/8 | 2 3/4 | 3/4 | 3/8 | 5 | 3/8 | 3/16 |
| 2 1/2 | 5 | 9 3/4 | 3 3/4 | 1 | 1 13/16 | 3 3/4 | 6 1/2 | 3/4 | 5/16 | 1/8 | 2 3/4 | 3/4 | 3/8 | 5 | 3/8 | 3/16 |
| 2 3/4 | 5 1/2 | 10 3/8 | 4 1/8 | 1 1/4 | 1 13/16 | 4 1/8 | 7 3/8 | 3/4 | 5/16 | 1/8 | 3 | 3/4 | 3/8 | 5 | 3/8 | 3/16 |
| 3 | 6 | 11 1/8 | 4 1/2 | 1 1/4 | 2 1/4 | 4 1/2 | 8 1/4 | 11/16 | 5/16 | 1/8 | 3 1/8 | 1 | 1/2 | 6 | 1/2 | 1/4 |
| 3 1/4 | 6 1/2 | 12 | 4 7/8 | 1 1/4 | 2 1/4 | 4 7/8 | 8 3/4 | 13/16 | 1/2 | 3/8 | 3 1/8 | 1 | 1/2 | 6 | 1/2 | 3/16 |
| 3 1/2 | 7 | 12 1/2 | 5 1/4 | 1 5/16 | 2 5/16 | 5 1/4 | 9 3/8 | 13/16 | 1/2 | 1/4 | 3 1/2 | 1 | 1/2 | 6 | 1/2 | 3/16 |
| 3 3/4 | 7 1/2 | 13 3/8 | 5 5/8 | 1 3/8 | 2 3/8 | 5 5/8 | 10 1/8 | 7/8 | 1/2 | 1/4 | 3 3/4 | 1 | 1/2 | 6 | 1 | 1/2 |
| 4 | 8 | 14 3/8 | 6 | 1 1/2 | 2 3/8 | 6 | 10 3/4 | 15/16 | 5/16 | 1/4 | 4 | 1 1/8 | 1/2 | 6 | 1 | 1/2 |
| 4 1/4 | 8 1/2 | 15 1/4 | 6 3/8 | 1 5/8 | 2 3/4 | 6 3/8 | 11 3/8 | 15/16 | 5/16 | 1/4 | 4 1/4 | 1 1/8 | 1/2 | 6 | 1 1/8 | 5/16 |
| 4 1/2 | 9 | 16 1/4 | 6 3/4 | 1 3/4 | 2 3/4 | 6 3/4 | 12 1/4 | 1 | 3/8 | 1/4 | 4 1/2 | 1 1/8 | 1/2 | 8 | 1 1/8 | 5/16 |
| 5 | 10 | 18 | 7 1/2 | 1 7/8 | 3 5/16 | 7 1/2 | 13 1/2 | 1 1/16 | 11/16 | 1/4 | 4 7/8 | 1 1/4 | 1 | 8 | 1 1/4 | 3/8 |
| 5 1/2 | 11 | 19 1/2 | 8 1/4 | 2 1/16 | 3 3/8 | 8 1/4 | 15 | 1 1/8 | 3/4 | 1/4 | 5 1/8 | 1 1/4 | 1 | 8 | 1 1/8 | 11/16 |
| 6 | 12 | 21 | 9 | 2 1/4 | 3 11/16 | 9 | 16 1/2 | 1 1/16 | 13/16 | 3/8 | 5 3/8 | 1 3/8 | 1 1/4 | 8 | 1 1/2 | 3/4 |
| 6 1/2 | 13 | 23 | 9 3/4 | 2 1/2 | 3 15/16 | 9 3/4 | 17 1/2 | 1 1/4 | 13/16 | 3/8 | 6 1/4 | 1 3/8 | 1 1/2 | 8 | 1 3/8 | 3/8 |
| 7 | 14 | 24 1/2 | 10 1/2 | 2 3/8 | 4 1/4 | 10 1/2 | 19 | 1 5/16 | 7/8 | 3/8 | 6 3/8 | 1 1/2 | 1 1/4 | 8 | 1 3/8 | 3/8 |
| 7 1/2 | 15 | 26 | 11 1/4 | 2 3/4 | 4 3/8 | 11 1/4 | 20 1/4 | 1 3/8 | 15/16 | 3/8 | 6 3/4 | 1 3/8 | 1 1/4 | 8 | 1 3/8 | 3/8 |
| 8 | 16 | 27 1/2 | 12 | 3 | 4 3/4 | 12 | 21 1/2 | 1 7/16 | 15/16 | 3/8 | 7 1/8 | 1 3/8 | 1 3/8 | 8 | 1 3/8 | 3/8 |
| 8 1/2 | 17 | 29 | 12 3/4 | 3 1/4 | 5 | 12 3/4 | 22 3/4 | 1 7/16 | 1 1/16 | 3/8 | 8 | 1 3/8 | 1 3/8 | 10 | 1 3/8 | 7/16 |
| 9 | 18 | 31 | 13 1/2 | 3 1/2 | 5 1/4 | 13 1/2 | 24 1/4 | 1 7/16 | 1 1/16 | 3/8 | 8 1/2 | 1 3/8 | 1 3/8 | 10 | 1 3/8 | 7/16 |
| 9 1/2 | 19 | 32 1/2 | 14 1/4 | 3 3/4 | 5 5/8 | 14 1/4 | 25 1/2 | 1 1/2 | 1 3/16 | 1/2 | 8 3/4 | 1 3/8 | 1 1/2 | 10 | 2 | 1 |
| 10 | 20 | 34 | 15 | 3 3/4 | 5 11/16 | 15 | 26 1/2 | 1 5/8 | 1 1/4 | 1/2 | 9 1/8 | 1 1/2 | 1 1/2 | 10 | 2 | 1 |
| 10 1/2 | 21 | 36 | 15 3/4 | 4 | 5 13/16 | 15 3/4 | 28 1/2 | 1 5/8 | 1 1/4 | 1/2 | 9 3/4 | 1 1/2 | 1 1/2 | 10 | 2 1/2 | 1 |
| 11 | 22 | 37 1/2 | 16 1/2 | 4 1/4 | 6 1/16 | 16 1/2 | 29 1/2 | 1 3/4 | 1 3/8 | 1/2 | 10 1/8 | 1 5/8 | 1 1/2 | 12 | 2 1/2 | 1 |
| 11 1/2 | 23 | 39 | 17 1/4 | 4 1/4 | 6 3/16 | 17 1/4 | 30 3/4 | 1 7/8 | 1 3/8 | 1/2 | 10 1/2 | 1 5/8 | 1 3/4 | 12 | 2 1/2 | 1 |
| 12 | 24 | 41 | 18 | 4 1/2 | 6 1/2 | 18 | 32 1/2 | 1 7/8 | 1 1/2 | 1/2 | 11 | 1 5/8 | 1 3/4 | 12 | 2 1/2 | 1 |

STANDARD SHAFT COUPLING

This coupling has proved very serviceable in hard, every-day work.

S. A. WORCESTER.

### Jig for Babbitting a Number of Boxes at One Setting.

Editor American Machinist:

The illustrations show a jig for babbitting a number of boxes at one setting, and while not new it may be of benefit to some of your readers who have this kind of work to do.

Fig. 2 *C* is a flat table bored to receive the shaft *E* which is turned with a shoulder. *B* is the casting to be babbitted at the boxes *A* and *F*. The casting is placed on the table *C* with the shaft *E* and stops *D* in position. The stops *D* are bored to receive the outer end of the babbitting shafts *G*.

The shaft *E* is drilled to receive the inner end of the shafts *G* which are turned to fit these holes which are the same center distance from the table face as are the holes in the stops *D*. It takes but a few minutes to set up this rig to babbitt the whole nineteen boxes, including the box *F*.

We have quite a number of castings like those shown in Fig. 5 to be planed at *B*, all to be duplicates. Instead of readjusting the surface gage at every boss, I made a hight gage, Fig. 4, with one fixed arm for every boss, which proved very satisfactory.

B. G. N.

Fig. 1 Top sectional view showing a few of the babbitting shafts in position

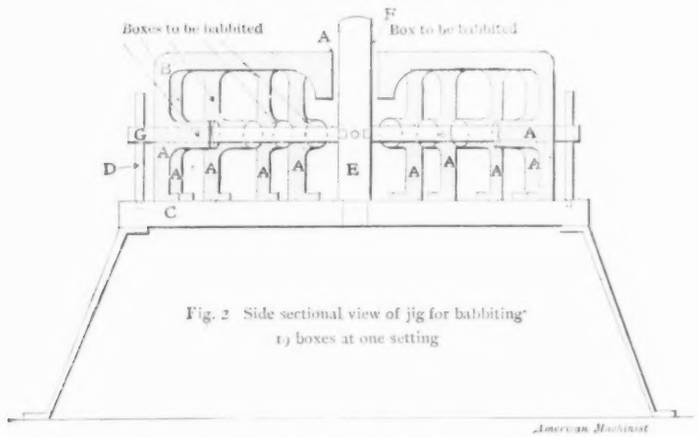



Fig. 2 Side sectional view of jig for babbiting 19 boxes at one setting

THE JIG AND THE WORK.

### That Cone-Fulley Bearing.

Editor American Machinist:

In the description of the new radial drill at page 703, I can find nothing to indicate that the cone pulley bearing there shown is to be considered as new or anything more than a piece of good design.

Your correspondents, Gould & Eberhardt, at page 810, call attention to the fact that the bearing is not new and inform us that a patent was issued to them in 1902 for the device.

In a patent to M. C. Johnson, dated August 25, 1885, No. 324,845, the same device is shown on sheet 3, Fig. 10, of the drawings, no claim being made for the same.

The fact that later patents to M. C. Johnson, dated May 28, 1895, No. 539,945, and July 30, 1895, No. 543,486, show the same principle applied to pulleys and gears, would seem to show that its merits have long been recognized by at least one good mechanic.

JOHN W. BOYNTON.

New Bedford, Mass.

### Helical Gearing for Lathe Drives.

Editor American Machinist:

It is getting lately so that it is almost impossible to pick up a technical paper without finding a description of one or more new machine tools in which the cone pulley has been abandoned as a means for varying the speed, and some sort of a speed box adopted in its place.

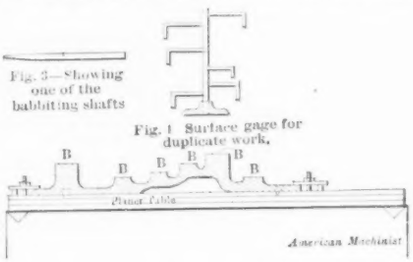



FIG. 5. CASTING TO BE PLANED.

Many of these are patented devices, and some of them show great ingenuity, but it seems that the designers of them are all traveling along practically beaten paths, or, in other words, are in a rut, and seem afraid to plan something original. While there are various arrangements they are all practically made up of the same component parts, spur gears, with friction or positive clutches. It seems to me that it is overlooking a very broad and promising field not to go into the use of helical gearing for change boxes, as helical gears are in such common use, now that there is no longer any question as to their durability, efficiency and smooth running qualities. By a judicious arrangement of the shafts and gears more different combinations can be got, with fewer parts and less complication, than by any other device known to me. It would seem that this would be especially advantageous for the new high-speed lathes, as it would make the connection between the power and the work more nearly direct, and would make a machine which would give no trouble from chattering, if the other parts of the lathe were in adequate proportion.

So far as I know, there is but one maker who has been bold enough to put a helical gear-driven lathe on the market, but I believe that within a very short time we shall see such tools taking the lead, as the lathe is at present in a period of transition, and I do not believe that the lathe which is to be evolved in the fight between the high-speed steels and the machines is going to be of one of the types with which we are familiar, only made stiffer in the various parts, but that it will be more along the lines laid down by Professor Sweet, with the bed of a square, tubular form, carriage running on one flat and one V-way and the power transmitted through helical gears.

Other machines which would be greatly simplified and improved by the adoption of helical gearing in place of the bevel and spur gearing used at present, are the vertical and horizontal drilling and bor-

ing machines and radial and gang drills. I have had considerable experience lately in the application of helical gears for the various purposes mentioned and have found them very satisfactory in every way, including first cost, efficiency, durability, neatness of design and general convenience. WILSON P. HUNT.

### Effect of the War Upon Japanese Business.

An interesting picture of conditions in Japan is afforded by a communication from the Japanese manager of the *Eikoku Shogyo Zasshi*, published at Tokyo, recently received by the Department of Commerce and Labor through its Bureau of Statistics. The communication, which appears in the May number of the *British Trade Journal*, indicates that commercial and financial conditions have not as yet been seriously affected by the Russo-Japanese war, and this statement is verified, so far as relates to commerce with the United States, by the official figures showing the trade of the United States with Japan during the present year as compared with earlier periods.

Commenting upon trade and financial conditions in the Japanese Empire, the writer above referred to says:

"When the Russo-Japanese negotiations were broken off and the hostilities were opened between these two powers we feared that a great panic would occur in our economic world and our commerce and industry would be upset to a large extent, the whole energy of the people being concentrated on the war. But this turned out to be a false fear. The war does not so much affect our trade as we expected; transactions are done very smoothly; stocks which suffered from a fall for a short time have risen again to their prices, and factories enjoy their usual profit. Nor does it make our people so greatly excited as you may think, tho we Japanese pride ourselves on being the most patriotic nation on earth. At home, our conversations are as merry and innocent as ever, and in the street we seen nothing warlike except noisy newsboys delivering specials of happy tidings in the form of our brilliant victories both on land and sea. Business men and laborers are calmly attending to their own tasks, and there is no excitement among them. In fact, our people seem to rightly understand that it is an important duty on their part, especially at this juncture, to apply themselves to their business with as much assiduity as their soldiers do to battles. Such being the state of things in Japan, however long the war may last her commerce and industry will not be much affected by it; nay, they will continue the progress they have been used to make during these past decades."

This statement is borne out by statistics of American trade with Japan, which has increased during the past fiscal year.

### Legal Notes.

BY E. P. BUFFET, LL.B.

WARRANTIES ON MACHINERY AND RECOVERY FOR PERSONAL INJURIES.

The McCormick Harvesting Machine Company sold to Daniel Birdsinger and his brother a corn husker and shredder, providing in the contract of sale, "It is distinctly understood that the above-mentioned machine is purchased subject to the following warranty and no other. . . . McCormick Harvesting Machine Company warrants this machine to do good work, to be well made, of good materials, and to be durable if used with proper care."

One day when Daniel Birdsinger was using the machine his hand was caught between the snapping rollers and had to be amputated, as an outcome of which he sued the company upon the above warranty.

It appeared that the accident happened as follows: He had been feeding the machine and stopped to clean the snapping rollers of stalks with which they had become clogged. In order to clean them the gearing was thrown off by a safety lever provided for the purpose, but they started to turn again without warning. Evidence was offered to show that a part of the gearing driving the rollers had become broken; that this caused a bolt to slip out of its place which became wedged in the gearing so as to render ineffective the safety lever; and that the rollers were thus set in motion notwithstanding the proper use of the lever. Upon the trial the jury found that the defendant had violated its warranty in failing to provide a durable machine, well made and of good materials, and that the plaintiff's injury was due thereto. A verdict for substantial damages was rendered in favor of the plaintiff. The defendant appealed.

In reversing the judgment, Smith, J., of the Appellate Division, Third Dept., cites some cases bringing out the rule that where the warranty is general the warrantor is usually responsible only for the immediate and necessary consequences of its breach (*i. e.*, the lessening in value of the article), but in case of a special warranty consequential damages may be recovered if natural and necessary or within the contemplation of the parties. (Without attempting a precise definition of general and special warranties, it may be explained that where reference is had to a particular purpose for which the property is to be used out of the ordinary course the warranty is special.)

That this rule is not a simple and invariable one, however, may be seen from Justice Smith's remarks, which relate to matters of such importance to machinery manufacturers that they are worth quoting at some length.

"It may be difficult," says he, "to sustain the rule that only in case of special warranty can consequential damages be recovered. It has been held that if a gun or a boiler explodes, a vendee may recover consequential damages for a breach of the warranty that it was well made and sound. Primarily the contract of warranty is simply a contract to make good to the vendee the value of the article sold. In no case have further and consequential damages been allowed, unless there is indicated an intention to contract as against such further damage. While generally that intention is indicated by a special warranty, it may be, as in the warranty of a gun or boiler as sound and well made, that the warrantor is presumed to have contemplated as damages personal injuries as being the natural and probable result of a breach of the warranty. In the case at bar we find no special warranty. The warranty is general. The accident was not one which was a natural or probable result of a breach of that warranty. With a break in the machinery, the safety lever might not be expected to work, but it could not reasonably have been anticipated that the rollers would stop revolving for a sufficient time to induce the operator to put his hands upon them, and then, without apparent cause commence to revolve and cause the injury which has been here suffered."

Birdsinger contended, however, that tho the warranty was in form a general one, since the machine had but a single use, to wit, the shredding and husking of corn, there was in effect a special warranty. But the court replies that even if this is true he may not be entitled to consequential damages. "It is not enough . . . to authorize the recovery of all consequential damages that the warranty should be special. The nature of the warranty must be such as to indicate the damage suffered as that contemplated by the contract of warranty. Within the respondent's contention as to the legal effect of this warranty, if a quantity of corn could be bruised in passing through the machine, such damage might well be held to be the consequential damage within the contemplation of the parties, and as such recoverable," but otherwise as to personal injuries. On the contrary, where a horse was warranted to be "sound, kind and true, gentle and quiet in harness, and suitable for use by plaintiff in his practise as a physician, to drive in harness as a carriage horse," damages for personal injuries have been allowed. "The ultimate question in the consideration of all contracts," says Justice Smith, "is the determination of the real intention of the parties."

We may note in passing that the word "intention" as used by lawyers means *legal intention*, to be inferred from words and conduct, and may be quite a different matter from the hidden psychological processes of the parties. Such technicality may not affect the result of the present case, but it is well that the lay reader should know what this oft-repeated word signifies.

92 App. Div. (N. Y.) 35.

ANOTHER BUCOLIC—THE RIGHT TO CHANGE ONE'S MIND.

Geo. W. Rockwell, of Horseheads, N. Y., ordered of E. Bement & Sons, Lansing, Mich., eight Ajax cultivators at the price $4.25 each. A few days later he wrote them saying that he had since procured for $4.00 a sample cultivator which he found as good as the Ajax, and that the Bements might come down 25 cents on their price or cancel the order. Further correspondence followed, the goods were shipped but were not accepted and the Bements brought action against him in a Justice's court. They were non-suited and appealed to the County court, where this judgment was reversed. Upon defendant's appeal to the Appellate Division the county judge was reversed. Says the court, per Smith, J.: "It is unquestioned law that an order unaccepted constitutes no contract, and until its acceptance by the party upon whom the order is drawn the right of revocation is clear."

92 App. Div. (N. Y.) 44.

## American Competition Felt by German Tool Builders.

Following is a condensed extract from the trade report of the German Machine Tool Builders' Association for the year ending Mar. 31, 1904, presented at a meeting, May 9:

Among the more finished branches of work the machinery industry is least favored because the demand does not fill the great capacity of the plants, and the competition often results in unprofitable prices. Machine tools are unfortunately no exception. Indeed, in the course of the fiscal year and up to the latest time the requirements have gradually been strengthening, and at home, particularly in the last months, an increased demand has developed. But in general character there is not yet much change from the last few years and prices have been unable to recover; in fact, business is often done at a loss. The shops are driven to underbidding, and besides, the big frauds that are always present among machines in the market have a bad effect on prices.

As regards foreign trade, the German machine-tool balance has so far retrograded in the calendar year 1903 that the imports rose from 1802 tons to 2,363 tons and the exports sank from 21,054 to 20,465 tons. The cause lay partly in the economic depression in the United States, since the American factories, once more growing keen for foreign trade, delivered 1,142 tons of machine tools in Germany in 1903, against 608 tons the preceding year; while on the other hand the German exports to some Western European countries, such as Belgium, France and Spain, diminished not inconsiderably, so that notwithstanding increased shipments to Great Britain, Italy, Austria-Hungary and Switzerland the falling off was in round numbers 600 tons. In the first quarter of 1904 the tendency has unfortunately intensified, since the imports have increased decidedly faster than the exports, viz., about 90 per cent. (the American upward of 100 per cent.) while the exports have risen only about 15 per cent. The German imports from America in the first quarter of 1904 are fully a third of those for the corresponding period of 1900, while the proportion for that part of 1902 was only about one-fourteenth. While the total machine-tool exports of the year 1902 were about eleven times the imports, they were in 1903 hardly nine times and in the first quarter of 1904 only six times.

The Russo-Japanese war has in the machine-tool line, as in all German commercial affairs, not yet had an unfavorable effect; at first because it was restricted to a naval war between the two hostile nations and in consequence of the confinement of the Russian squadron, traffic with Japan and China was not destroyed. The present land campaign in Manchuria should be of little consequence to commerce. On the other hand, it is safe to assume that the belligerents will in time develop large needs for all kinds of material to renew and improve their equipment. A few German machine-tool factories have already received respectable orders to build machines for Japanese military requirements. It therefore looks as if the European industrial nations would derive some benefit from the war in East Asia. This is upon the assumption that it does not become a general mêlée.

## Aluminum for Bobbins.

At a recent meeting of the "Société d'Encouragement pour l'Industrie Nationale," an interesting paper was read on the substitution of aluminum for wood in the machinery of spinning mills. In the textile industries—spinning, dyeing and silk weaving, among others—a wooden bobbin is generally used. This is cheap and easily worked, but it has many drawbacks. Being very hygrometric, it suffers from variations of temperature: this accounts for the fact that in spinning factories where the atmosphere is full of humidity the bobbins revolve irregularly, causing jerks which slacken the speed and occasion the threads to break. The result is waste of stuff and loss of time in joining the threads again. It has been proposed to substitute aluminum for wood. Bobbins made of this metal revolve in any temperature and any degree of humidity; their relative lightness (five aluminum bobbins weigh no more than two wooden boxes) allows the machines carrying them to move more quickly, or an equal speed may be obtained at less expense of motive power; finally the smaller volume of the bobbins diminishes the cost of transport. It was stated that several firms had adopted the use of aluminum bobbins and had found that they possessed many advantages.—*Consular Reports.*

Adam, William Tell and Sir Isaac Newton each had an affair with an apple, but each with different results.

## Cupola Fan Practise.*

The air required per ton of iron melted has been variously given from 30,000 to 33,000 cubic feet. As it is almost impossible to measure the air directly, it is necessary to resort to indirect methods of chemical analysis of the escaping gases. By analyzing a sufficient number of samples, the amount of air used in the combustion of the coke can be determined with considerable exactness. This also serves to show the nature of the gases produced.

On the average about 9 pounds of air are required per pound of carbon, and with coke containing an average of 90 per cent. carbon, this will be 8.1 pounds of air per pound of coke. In a tabulated report of a series of tests only about 50 per cent. of the carbon is burned to carbon dioxide; the remaining portion is burned to carbon monoxide, and liberates only one-third of its total heating value. One pound of carbon burned to carbon dioxide requires practically 12 pounds of air for combustion; the same burned to carbon monoxide requires only 6 pounds of air. In the first process 14,450 heat units are liberated, while in the second process only 4,400. From this it will be seen that in the present cupola practise less air is required than that necessary for perfect combustion; and only about two-thirds of the total heating value of the fuel is utilized, the remaining one-third escaping in the unburned carbon monoxide gases. The deeper and more intense the fire, the greater seems to be the percentage of carbon monoxide gas produced. In blast furnace practise this gas is present in quantities sufficient to make the gases highly valuable as fuel, either in the production of steam or for use in gas engines. While this discussion is somewhat foreign to the general purpose of this paper, it may be remarked that there is an opportunity for effecting considerable saving in fuel and a consequent increase in the melting ratio by devising some means whereby a more perfect combustion may be secured. The tests would indicate that the center blast tuyere, first proposed and tried by Mr. Thomas D. West, is a step in the right direction.

The pressure required to give a stated melting capacity with a given sized cupola depends, first, upon the melting ratio; second, upon the method of charging, and, third, upon the nature of the coke and iron used. In general, soft coke requires less pressure than hard coke, but does not give as good results. The speed of melting is decreased by the presence of large quantities of scrap or steel in the charge. However, if we take a standard method of charging, comprising a definite ratio of coke to iron and a definite percentage of scrap of uniform size, the variation in speed of melting, which will be produced

* From a paper, by W. H. Carrier, presented at the Indianapolis meeting, June, 1904, of the American Foundrymen's Association.

by different pressures, follows quite exact laws.

The resistance of the air offered by the cupola follows the general laws of fluid friction; that is to say, the amount of air forced through the cupola will vary as the square root of the pressure. For example: If we double the amount of air forced through the cupola, then the pressure will be increased $2^2$, or four times, and if the pressure is increased nine times, $\sqrt{9}$, or three times the amount of air will be forced through. Since the speed of melting with a fixed melting ratio must necessarily be proportional to the amount of air supplied to the cupola, we will have the speed of melting varying as the square root of the pressure.

The melting capacity of a cupola with a given pressure depends upon its size, and is nearly proportional to the area of the cross-section; hence to the square of the diameter inside the lining. This will not hold exactly with the ordinary side blast tuyere, as somewhat larger pressure is required with the large sizes of cupolas to force the air to the center of the charge. As a result of a number of tests, the following formula is determined for the average speed of melting:

$$W = 2 D^2 \sqrt{p};$$

$W$ = weight of iron in pounds per hour;
$D$ = diameter of the cupola inside lining in inches;
$p$ = pressure at the cupola in ounces per square inch.

This formula holds with a considerable degree of exactness for melting ratios of 10 to 1 with a good quality of hard coke, and for charges containing only a small amount of scrap. Variations in these conditions will of course vary the results. The air per minute required for various sizes of cupolas may be given by the formula:

$$C = \frac{D^2 \times \sqrt{p}}{2}$$

where
$C$ = cubic feet of air per minute required;
$D$ = diameter of the cupola inside lining in inches;
$p$ = pressure in ounces per square inch.

This is a safe factor for ordinary use and gives an allowance of about 10 per cent. for leakage, etc.

It is usually considered that a certain sized fan operating at a certain pressure will require a certain horse-power. This is the usual method of rating given by makers. This rating holds very well when the fans are delivering the amount of air specified at the given pressures, but there is considerable fallacy in using this as the correct horse-power, when applied to cupolas in ordinary practise, since the amount of air which the blower will handle is limited by the size of the cupola; and the horse-power required to operate the fan is dependent upon the amount of air which it is allowed to handle.

Each cubic foot of air per minute moved against a pressure of one ounce per square inch, or 9 pounds per square foot, represents the expenditure of .000272 horse-power—*i. e.*, with perfect efficiency, 37,000 cubic feet of air per minute moved against one ounce pressure will require one horse-power. A well constructed fan will give a maximum efficiency of about 60 per cent., therefore we will have .00045 horse-power per cubic foot of air per minute per ounce pressure.

The horse-power required for any sized cupola at any pressure is given by the formula:

$$\text{H. P.} = \frac{D^2 \sqrt{p^3}}{3800}$$

$D$ = diameter of cupola inside of lining in inches;
$p$ = pressure at the cupola in ounces per square inch.

The air delivery and horse-power of centrifugal blowers at a given pressure depend upon the sizes of the cupola to which they are applied. In this respect the centrifugal blower varies greatly from the positive pressure blower. With a positive pressure blower, as the resistance is increased, either by increasing the speed of the blower or by applying it to a smaller cupola, the pressure and horse-power are both increased in proportion. In the centrifugal blower the effect upon the horse-power is reversed. With the increase of resistance the pressure is increased, as in the positive blower, but the capacity and horse-power are both decreased. If the resistance against which the centrifugal blower is working is decreased, as by putting on a lighter charge, or by applying to a larger cupola, the pressure is decreased to a certain extent and the capacity and horse-power are increased. In this respect the centrifugal blower offers some advantages over the positive blower. The rotary blower, while positive in action, is limited in capacity and cannot adjust itself to the variations in demand for air, nor can its capacity and pressure be readily controlled by the operation of a blast gate, as with a centrifugal blower. The flexibility of operation secured with the centrifugal fan may be compared to the action of a spring. Its pressure increases in a certain measure with the increase of resistance; likewise decreases with the decrease of resistance; the volume supplied varies with the conditions of pressure, and at any time all of the air is supplied which the condition of the cupola will admit. This flexibility often makes the melting capacity of the cupola with a fan blower considerably greater than with a positive blower, owing to the fact that a larger quantity of air can be supplied when required. Another advantage of the centrifugal blower is that the same size can be applied to several sizes of cupolas without altering the speed and without greatly affecting the efficiency of the blower.

Practical tables show that the horse-power required when running open is about twice as much as that required when operating at rated capacity, and that when running closed it is only 28 per cent. as much as is required at rated capacity, or 14 per cent. of the horse-power required at free delivery. The increase in horse-power is proportional to the increase in capacity. The pressure increases from free delivery up to about 60 per cent. of the rated capacity; from 60 per cent. of the rated capacity to the closed outlet, the pressure again decreases, which shows that the maximum pressure is secured at 60 per cent. rated capacity. The rated capacity of the blower is based upon the capacity and pressure at which it will operate most economically.

The capacity under any condition is proportional to the speed of the fan, and the pressure is proportional to the square of the speed. From this it follows that the horse-power required to drive the fan will vary as the cube of the speed. For instance, suppose that a No. 11 cupola blower operating at 1,800 revolutions per minute requires 25 horse-power when attached to a certain cupola. Now, if the speed is increased from 1,800 to 1,980, or 10 per cent., then the horse-power will be increased to $1.10 \times 1.10 \times 1.10 = 1.33$ times, or an increase of 33 per cent. in horse-power, which will make the horse-power at 1,980 revolutions = 33.3. Also, if a No. 11 blower gives 10 ounces pressure at 1,800 revolutions per minute when applied to a certain cupola, it will give $1.10 \times 1.10 = 1.21$ times that pressure for an increase of 10 per cent. in speed; that is, at the speed of 1,980, the pressure will be 12.1 ounces.

The piping connections from blower to cupola affect considerably the results secured. With a short, straight pipe the pressure at the cupola will be practically the same as at the fan outlet. If, however, the connection is long and has a number of sharp bends, the pressure may be reduced several ounces. If the speed of the fan is not increased, the horse-power will be decreased by this resistance, but the melting capacity of the cupola will also be decreased. The pressure at the fan outlet will be slightly increased by the extra resistance offered by the fan. If, however, the fan is speeded up to secure the desired pressure at the cupola, then a considerably increased horse-power will be required to overcome the extra resistance of the piping.

---

An elderly German and a five-year-old boy went into a cigar store near the bridge entrance to use a telephone yesterday, and the boy, catching a glimpse of an electric fan in the place, shouted:

"Grandpa, how it comes dot breeze in der wheel?"

"Dot's telegraphed by electricity from Coneys Island," explained the elderly man. "Vhen dere ain't no sea breeze blowing dot electric fan stops so quick as lightning. Ve are getting more inventedness every day."—*New York Times.*

# AMERICAN MACHINIST

Issued Weekly by the

Hill Publishing Company

World Building, New York.

Also Published at 6 Bouverie Street, London, E. C.

*Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.*

*Address all business communications to the American Machinist, World Bldg., New York. Matter for reading columns may be addressed to the Editor.*

*Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.*

Subscription price $4 per year, postage prepaid, to any post office in North America; $5 in all foreign countries except Europe; Twenty-five Shillings there. No back numbers beyond current year. For sale by all newsdealers generally.

The AMERICAN MACHINIST Co., LTD., 6 Bouverie St., London, E. C., will serve all subscriptions for Europe and British possessions in Eastern Hemisphere. Price 25 Shillings.

Entered at New York Post Office as mail matter of the second class.

Cable Address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

*Of this issue of the* AMERICAN MACHINIST *18,000 copies are printed. Total for 1904, so far, 538,250. None sent regularly free. None taken back from news-stands. No back numbers beyond current year.*


Contents.


| | PAGE |
|---|---|
| The Flat Turret Lathe with Cross-Feeding Head | 845 |
| A Rational Basis for Wages | 850 |
| Rubber Culture in Mexico | 853 |
| The Flow of Steam Through Nozzles | 854 |
| Mechanical Progress in Japan | 856 |
| Forming Sheet Metal Parts Using Water as a Medium | 857 |
| The Engineer in the Foundry | 858 |
| Letters from Practical Men: The Value to Inventors of Being Able to Draw....Checking Tools Taken from Toolroom....Designing Ball Bearings....A Method of Marking Negatives....A Milling Fixture and a Drill Jig....A Toolroom Check Case....An Experimental Joint....A Drilling Jig and a Special Job of Countersinking....Terence Moriarity & Co....A Standard Flanged Shaft Coupling....Jig for Babbitting a Number of Boxes at One Setting....That Cone-Pulley Bearing....Helical Gearing for Lathe Drive | 859-867 |
| Effect of the War Upon Japanese Business | 867 |
| Legal Notes | 867 |
| American Competition Felt by German Tool Builders | 868 |
| Aluminum for Bobbins | 868 |
| Cupola Fan Practise | 868 |
| Branches of the A. S. M. E. | 870 |
| Responsibilty for Discipline | 870 |
| Financial Success of Public Utilities in Leeds | 870 |
| Some New Things | 871 |


### Branches of the A. S. M. E.

We have received a copy of the Preliminary Constitution and By-laws of the Milwaukee Branch of the American Society of Mechanical Engineers, of which the following constitute the council: M. A. Beck, president; Geo. P. Dravo, M. L. Jenkins, S. L. G. Knox, B. L. Worden and W. G. Starkweather, secretary and treasurer.

It seems that the council of the American Society of Mechanical Engineers, under paragraph 52 of the recently adopted constitution, is authorizing the organization of these branches (the first of which was organized in Cincinnati, as we announced some time ago) and which clause of the constitution vests in the council full authority to establish such branches at its discretion and under such regulations as the council may from time to time prescribe. We note that Article 7 of the constitution of the Milwaukee branch, which article relafes to initiation fees and annual dues, says that the annual dues of the members of the branch shall be equal to the amount remitted per member by the national society to the local society; from which we infer that there has been an agreement between the council of the A. S. M. E. and the local branches under which a certain proportion of the dues to the general society are to be remitted for the benefit of the local society. As we understand it, no initiation fees are to be required in the local branch for those members who belong to the general society, but in the case of associate members of the local branch (who have no standing as members in the general society) the initiation fee is $5.00, the annual dues for these members being the same as for the other members.

The by-laws of the Milwaukee branch provide for meetings to be held on the first Wednesday of each month, excepting July and August, and papers presented at such meetings may, after presentation and discussion by the local society, and with the permission of the member presenting the paper, be submitted by the local council to the general council.

### Responsibility for Discipline.

The destruction of the "Slocum" caused wide and excited discussion which has already apparently run its course so far as the daily press is concerned. The trend of the discussion while it lasted and of the coroner's investigation thus far has been in nothing perhaps more remarkable than in the tendency to settle upon one or two points which were not of the first importance in connection with the great calamity. It is proper of course to discuss the wisdom of the captain in running the boat so far after the fire was discovered and in beaching her where he did, and also to investigate the condition of the life preservers, but surely the great question is, why did the fire occur and why was it not immediately extinguished? It is a question of adequate apparatus and of crew organization, and for these things the captain surely was responsible. No words of appreciation from lifelong associates have the slightest bearing on the case, as against rotten hose, fire connections that could not be used and a crew the members of which individually distinguished themselves by taking care of themselves and neither saving nor attempting to save any other human life. One of the leading nautical papers argues that no one was to blame and that it was all the fault of the "system." Surely the captain was human and surely also he knew something of the dangers surrounding his craft. If the system was such that no adequate provision could be made for safety he could at least have refused to have anything to do with it. No system surely prevented him from looking into some of the possible conditions of safety and it does not appear that he did the first thing in the matter. It appears simply that he was merely one item of the "job lot" whose only recognized work was to keep the boat running as long as she would go. These are cruel words and second thought turns us back again upon the system, or the customary way of running things that we get into in all lines of business with not always the same risks of life. Those familiar with excursion and other steamers know very well that the "Slocum" was not essentially different from many others and presumably not more unsafe. The crew from the captain down were probably all driven by necessity to accept the positions they held, to make the best of things as they were and to take the chances. The public even now are quite ready, with full knowledge of the risk, to take the chances themselves, as was evidenced by the companion boat of the "Slocum" being crowded to her full capacity and having to refuse passengers on a trip ten days after the holocaust, so that the blame and the responsibility are still distributed over the entire community and the chances of great changes for the better are exceedingly remote.

### Financial Success of Public Utilities in Leeds.

Walter C. Ham, United States Consul at Hull, England, gives us in *Consular Reports* figures relating to the operation of the street railways in Leeds (which are owned and operated by the city) for the two years ending March, 1903 and 1904. For the latter year the gross income is $1,363,535.22 and the operating and maintenance expenses $723,629.21, leaving a gross profit of $639,906.01. From this last sum are deducted various charges for depreciation, income tax and interest, leaving a net profit of $416,619.79. And after redemption fund charges of $128,345.49 were taken from this, a surplus of $286,074.30 was left and turned over to the city treasurer to be used in reducing the city taxes. This is the largest profit shown by the tramways in any city in the United King-

dom. It should be remembered also that the fares on the Leeds tramways are 2 and 4 cents (American money), that advances in wages have been given employees the past year, and that every three months bonuses are allowed motormen who perform their duties without accident. So the public is benefited in two ways—by having low street-car fares and by a reduction in taxation.

The report on the electric lighting system, also owned by the city, shows a comparatively small profit for the year, light and power being supplied to the users at moderate prices.

What is undoubtedly the most important result of the public ownership of public utilities is not referred to in this report, however, and that is its effect in eliminating a fruitful source of corruption in municipal politics. It has been abundantly proven here that a very large share of the worst corruption of politics in American cities results from the fact that city officials have the power to grant valuable franchises to individuals or to corporations usually upon any terms they choose and that they yield altogether too easily to the influence of money which those seeking the franchises are ready to pay for a franchise under which the plain rights of the people now living and those to come are entirely disregarded.

With municipal ownership there will be politics and more or less bad management, but these the people have it in their power to correct at any time. The question of public ownership of public utilities is not to be settled by percentages of profits, nor yet by prices charged for service. It goes far deeper than that.

---

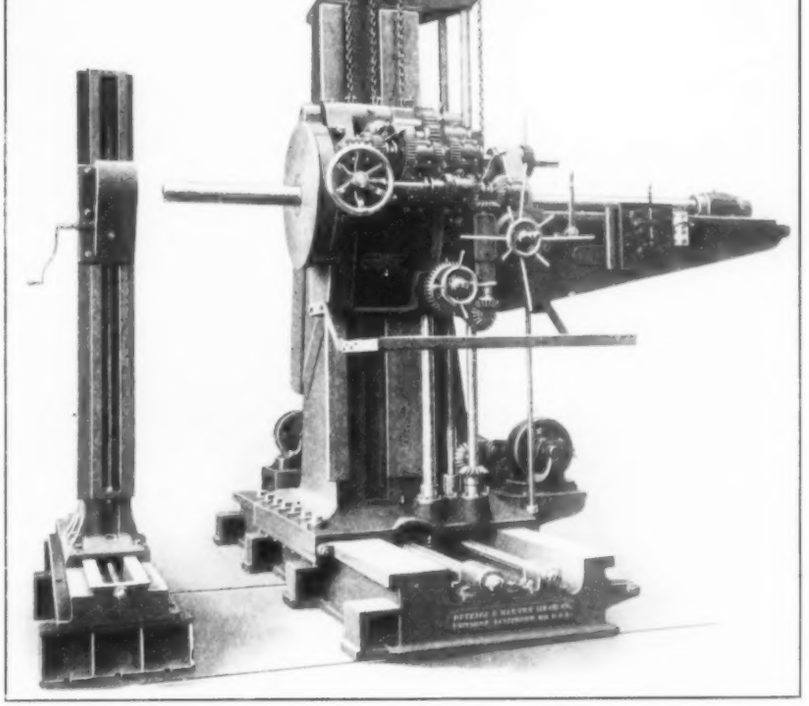
"There has been a marked tendency of late, in this seething, strenuous land of ours, to extol the so-called 'practical' man, and some quite noted exponents of the type have been hastening about, explaining the superior advantages of a limited education, while the current magazines, as you know, have been filled with pictures of so-called 'captains of industry,' who were said to have reached their well-deserved positions of great prominence chiefly because they had been untrammeled by misleading knowledge from books."

The above, from the recent commencement address of Foster Crowell at the Rensselaer Polytechnic Institute, strikes us as an unnecessary overstatement of fact. We do not know any who are "explaining the superior advantages of a limited education," and we fail to find the magazine which tells its readers that eminence and success are attained by "being untrammeled by misleading knowledge from books." There are those who believe that schools and books are often overrated and that for many purposes of life they are not indispensable, but that is very different.

## Some New Things.

### 72-INCH HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

This machine has a horizontal revolving spindle having a horizontal traverse parallel to the bed plate and at right angles to the bed for the column. This spindle is mounted on a saddle having a vertical movement of 72 inches on the face of the column. The column has a horizontal movement of 72 inches (or more, if desired) on the runway. Fast and slow power movements for the spindle and column and power feeds and quick return for the spindle in either direction are provided; hand feeds are provided for all motions. The bed is a box-shaped casting. The top surface consists of a front and rear bearing surface 14 inches and 8½ inches wide, respectively. Width of the face of the bed over all, 56 inches, and depth 18 inches. The column is a tapering, box-shaped casting with base 71 inches wide by 81 inches long. At the rear and side are located the driving gearing and motor for rotating the spindle and for feeding the column and saddle. The spindle saddle is a box-shaped casting with a bearing on the vertical face of the column 56 inches long. On the saddle are cast the bearing for the spindle rotating sleeve (37 inches long) and the bearings for the driving shafts and gears. The saddle is counterbalanced. The spindle is of hammered steel 5½, 5 or 6½ inches diameter with a No. 6 Morse taper hole in the end. The spindle is ground to a sliding fit in a sleeve 46 inches long. The sleeve is slightly tapered on its outside and rotates in a bronze-bushed bearing 37 inches long in the saddle. Bronze and steel thrust-washers front and rear and take-up collars are provided for wear. When motor driven the driving mechanism for the spindle consists of a 7½ horse-power reversible motor of the constant-speed type, direct connected to the driving gearing and mounted on the base of the column. The work bed or bed-plate is a flat, box-shaped casting 12 inches deep with T-slots on its top surface, cross-ribbed and reinforced under T-slots. It is tongued and bolted to the bed. The dimensions of the bed-plate are made to conform to the requirements of customers. The outer support for the boring bar consists of an upright post carrying on its vertical face a vertically adjustable bearing for the end of the boring bar. This bearing is fitted with a stationary bushing suitable for the bar. It has a vertical bearing of 24 inches on the face of the post. The post slides horizontally, parallel to the main column on the supplementary bed resting on the bed-plate. Adjustments in the outer support are made by means of screws by hand. The boring and drilling feeds are eight in number, reversible and installed on the saddle. They range from .007 to .4 inch per turn of spindle. The milling feeds for the saddle and column are eight in number, reversible and installed on the saddle. They range from .01 to .5 inch per turn of spindle. The speeds for the spindle are twenty in number, ten through the sleeve gear and ten through the face-plate gear. The changes of speed are made by means of a cone of gears and by levers operating



HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

clutches. Four changes of speed are obtained by shifting the levers and without changing step of cone. All power and hand movements, fast and slow, for spindle, saddle and column are controlled by the operator from his platform attached to the saddle. The levers are conveniently located within reach of the operator. The rapid movement of the saddle and column is obtained by an independent reversible motor of 7½ horse-power mounted on the supplementary base at the rear end of the bed. The spindle has 72-inch traverse. Center of spindle to bed-plate in its lowest position is 38 inches and in its highest position 120 inches. The machine is built by the Detrick & Harvey Machine Company, Baltimore, Md.

C & C ELECTRIC COMPANY'S TYPE "S" DYNAMOS AND MOTORS.

The C & C Electric Company, of New York, has recently brought out a new line of dynamos and motors, designated as type "S," which are built in sizes from 1 to 50 horse-power, or ¾ to 40 kilowatts. These machines have been designed especially as motors for machine tools and for machinery of all kinds where a wide range of speed regulation by means of field control and great overload capacities are required. The machines are designed for a maximum temperature rise of 30 degrees Cent. after 24 hours' full-load run and an overload capacity of 50 per cent. for two hours, or 100 per cent. for one-half hour without injury. Thorough tests show that these requirements are more than satisfied.

Fig. 1 shows the open, floor pattern, type "S" motor, and Fig. 2 the vertical motor.

The frame or magnet-yoke of the machine is of a special grade of soft cast steel; the feet or supporting brackets, as well as the four pole-pieces, are cast solid as part of this frame; while the pole-shoes

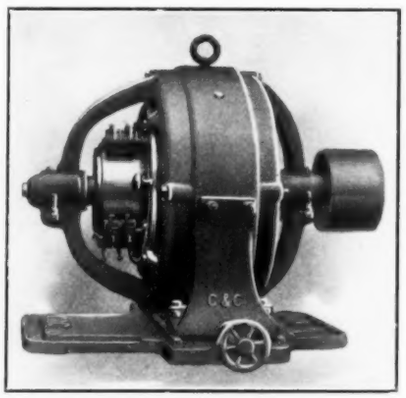


FIG. 1. OPEN FLOOR PATTERN, TYPE "S" C & C MOTOR.

which are attached to the pole-pieces by means of four bolts passing through from the outside of the frame, are also of very soft cast steel; the armature and brush rigging are carried by two gray-iron brackets bolted to the magnet-frame; the journal housings are carried as part of these brackets; the bearings are of the self-oiling, self-aligning type, each being fitted with two brass oil rings which dip into deep oil-wells. Provision is made against the oil getting into the armature by turning on the shaft just beyond each journal a series of oil-slings, as well as by the application of gray-iron oil-guards. The supporting brackets are so arranged that the machine can be attached either to the wall or to the ceiling. The terminal-blocks to which the lead-wires are attached are of slate and are bolted on opposite sides of the machine, thus separating the terminals of opposite polarity. The field-coils are wound on metal bobbins, making them practically indestructible as well as readily removable.

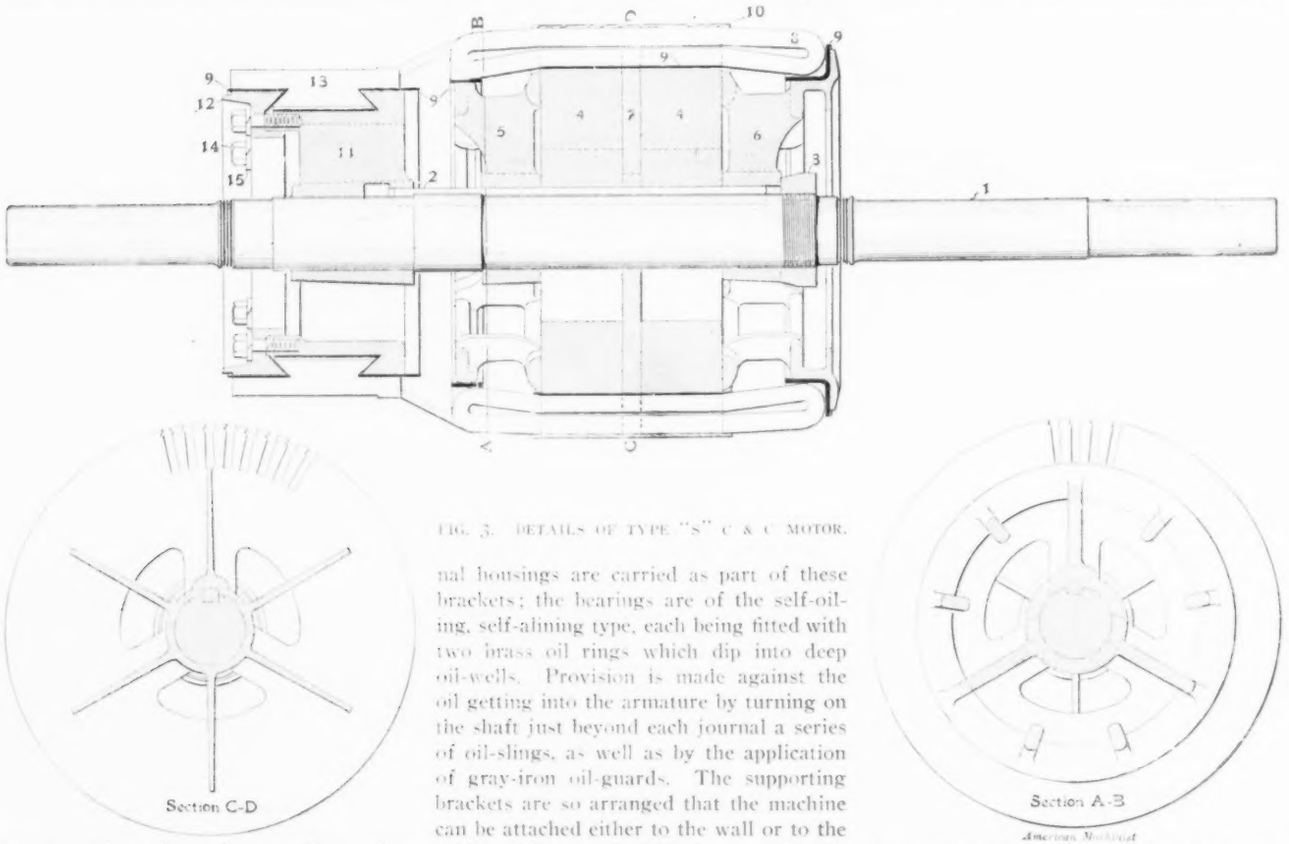



FIG. 3. DETAILS OF TYPE "S" C & C MOTOR.

The brush-holders, which carry carbon brushes, are attached by means of insulated studs to a gray-iron ring which is clamped between four lugs, which are cast as part of the bracket ring. Two knobs are attached to the brush rocker-ring, by means of which the brushes can be readily and simultaneously moved when occasion requires. This class of brush-holder construction, in which the brush-holders are rigidly supported from the frame of the machine, assures reliability of contact, and absolute steadiness of the brush-holders and brushes.

It is in the novel construction of the armature of this machine, however, that such results in the way of low temperature rise and great overload capacity are obtained. Fig. 3 shows, respectively, a longitudinal section of the armature, a transverse section through the ventilating spider, and a transverse section through the armature end-plate. The component parts of the armature are built up on the shaft (1), which shaft is fitted with keys for the commutator and the armature body. The gray-iron armature end-plate (5) is placed first on the shaft, then the slotted, soft-steel armature disks with the ventilating spider (7) between the two sections of the disk, and then the gray-iron armature head (6) is placed in position, and the whole securely clamped together by means of the armature nut (3) which is screwed on the shaft. The armature disks, besides being punched with slots for receiving the armature coils, have three additional holes punched therein radiating from the center shaft hole. When

the disks are assembled these three holes form air tunnels and give additional radiating surface to the armature body. The end-plates are spiders, the arms of which as well as the arms of the ventilating spider, act as the blades of a fan. The commutator tube (11), which is of gray iron, is also of the spider construction, and when the armature is in motion fresh air is drawn with considerable velocity through the commutator, through the armature end-plate, the armature disks, the ventilating spider and the armature head. Three of the arms of the ventilating spider bisect the tunnels formed in the armature core, with the result that part of the air which rushes through these tunnels is diverted by these arms, and is forced up through the openings between the two sections of disks forming the armature body, and is sprayed against the pole-pieces and field-coils.

The commutator is of very large diam-

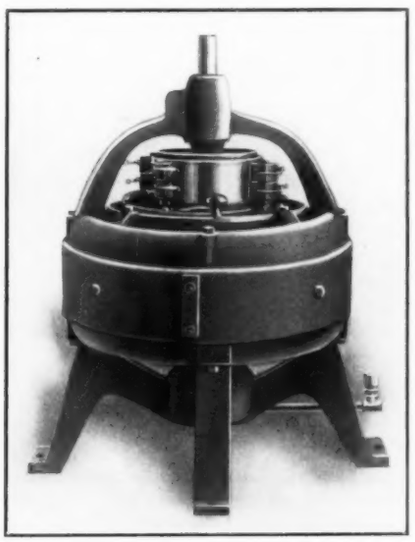


FIG. 2. TYPE "S" VERTICAL C & C MOTOR.

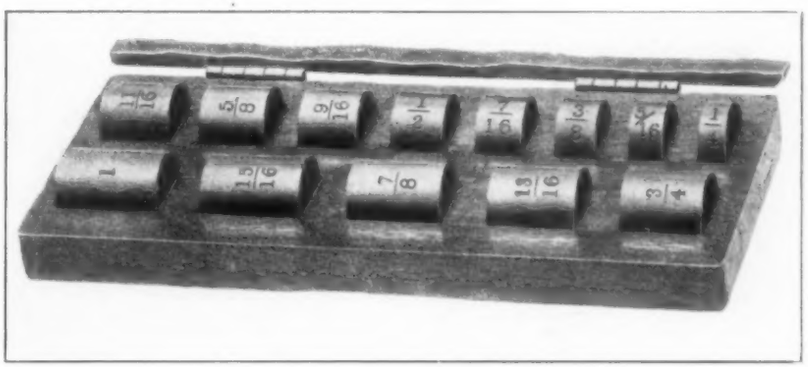
eter and width, and so designed that the bars are clamped immovably in position, so that there is no danger of the bars loosening and forming a rough commutator.

The type "S" machines are made also in the enclosed and semi-enclosed types; and as dynamos arranged either for belting or direct connecting to engines of various classes.

An attractive bulletin, No. 151-M, giving a complete description and many illustrations of this interesting line of machines, will be sent to those interested, who will address on a business letter head the C & C Electric Company, 143 Liberty street, New York.

### SIZE BLOCKS.

The accompanying illustration shows a set of size blocks made by the Meisel Press & Manufacturing Company, 944 to 948 Dorchester avenue, Boston, Mass. These blocks are made of hardened steel ground accurately to size. Three sets of different sizes are regularly made, from ¼ to 1 inch, from ¼ inch to 2 inches and from ¼ inch to 3 inches, graded in sixteenths of an inch. They can, however, be procured with a finer gradation if desired. Each set is furnished in a suitable

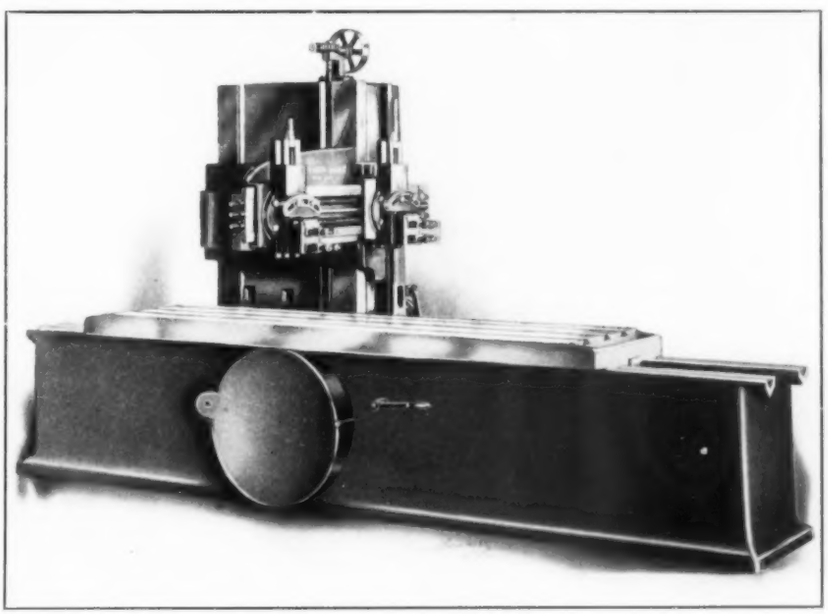



A SET OF SIZE BLOCKS.

box. It will be noticed that the blocks are round, and that there is but one size on each block, thus making it less likely for a mistake in size to be made than with blocks of rectangular form with more than one size on them. The makers have installed a complete line of special machines for their production.

### A NEW OPEN-SIDE PLANER.

The half-tone shows a new open-side planer built by the Cleveland Planer Works, 1260 Superior street, Cleveland, Ohio. The view here given of the tool suggests simplicity of construction, and, having been designed to meet the requirements of the high-speed steels and the practises which they entail, strength and rigidity are claimed for it. The box bed is cast with the top closed and is also ribbed at intervals, three of the ribs or partitions being opposite the base of the column, which, up to the hight of the platen, is cast integral with the bed. The upper column, which is box section, is secured to the bed by broad flanges. The V's are of large surface with 100-degree angle, with oil pockets and automatic oilers which carry the oil to the tops of the V's and insure perfect and constant lubrication. The machines of the larger sizes have, in addition to the crossrail, side heads which operate independently, and with the crossrail removed, can be worked the entire hight of the column. All the feeds are automatic in either direction and can be operated from either side of the machine. All the gears are encased, and no part of the machine extends below the floor. Two belts are used for driving, and these are shipped separately and so that they are noiseless. The table return is made from 2½ to 1 to 4 to 1, as may be required, and the drive may be either parallel with the bed or at right angles to it. The planer is built in all the usual sizes from 30 to 72 inches and of any length.



A NEW OPEN-SIDE PLANER.

THE FLATHER AUTOMATIC GEAR CUTTER.

The half-tone, Fig. 1, shows a new automatic gear cutter built by the E. J. Flather Manufacturing Company, Nashua N. H. It cuts spur gears up to 30 inches diameter and 9 inches face, using cutters up to 4 diametral pitch. It can be built, if required, to cut gears to 36 inches diameter. The half-tone shows the general construction and appearance of the machine. The head carrying the work spindle is clamped, when adjusted for hight, by a movement which does not affect the spindle. This device is shown in Fig. 2. *A* is a cross-section of the upper portion of the frame, and *B* of the sliding head; *C* is a binding nut, and *D* a pin or lever by which it is turned; *E* is the hub of the index wheel, and *F* the front of the work-carrying spindle. By turning the nut *C* the sliding plate *G* is pressed against the back of the frame, and the head *B* is drawn against the front of the frame, binding it firmly at *a a*. The head is raised and lowered by a hand-wheel-operated screw with graduations for hight in thousandths of an inch. The work spindle, a crucible steel forging, is bored to No. 12 Brown & Sharpe taper. The carriage is heavy, with wide bearings, well gibbed, and with felt wipers to exclude chips and dust from the slides. The cutter spindle, hardened and ground, runs in a phosphor-bronze sleeve with take-up for wear. One cutter arbor is furnished with the machine. There is a special device for locating the cutter centrally with the work. The spindle has a worm drive, the worm running constantly in oil. The return of the carriage after each cut is rapid and constant, being independent of the cutting speed. The length of cut is adjusted by sliding dogs, and the carriage may be run back clear of the work without changing them. The indexing mechanism is positive, and it is impossible for it to operate after the cutter has entered the work, or to index beyond the space for which it is set. The indexing is not affected by the speed. The worm drive of the index wheel can be disengaged and re-engaged when the work is turned to the desired position. The indexing is not affected by the speed. None of the motions of the machine depend upon momentum to compensate the movement or upon friction to carry them. The work arbor and the cutter arbor are both drawn into taper sockets by draw-bolts which also eject them. All the cylindrical bearings are ground and the plain bearing surfaces are accurately scraped. The machine complete weighs 2,500 pounds.

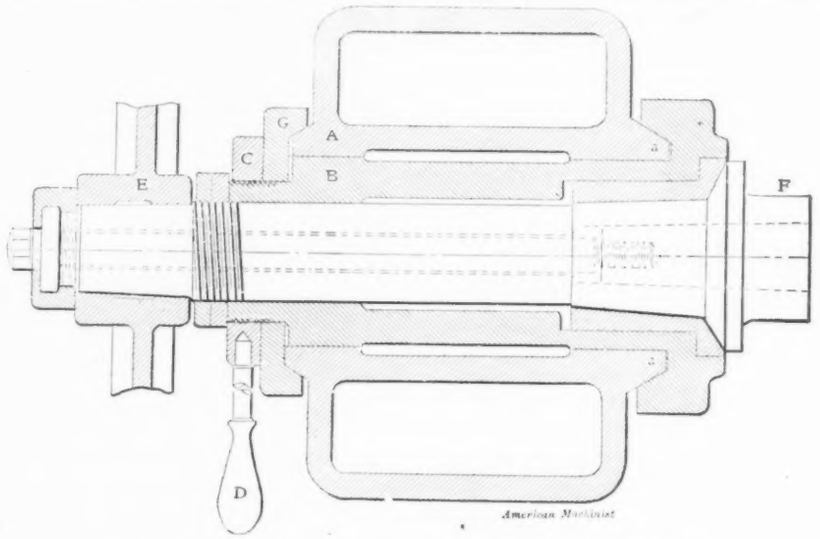



FIG. 2. SECTION OF WORK CARRYING HEAD AND CLAMPING DEVICE.

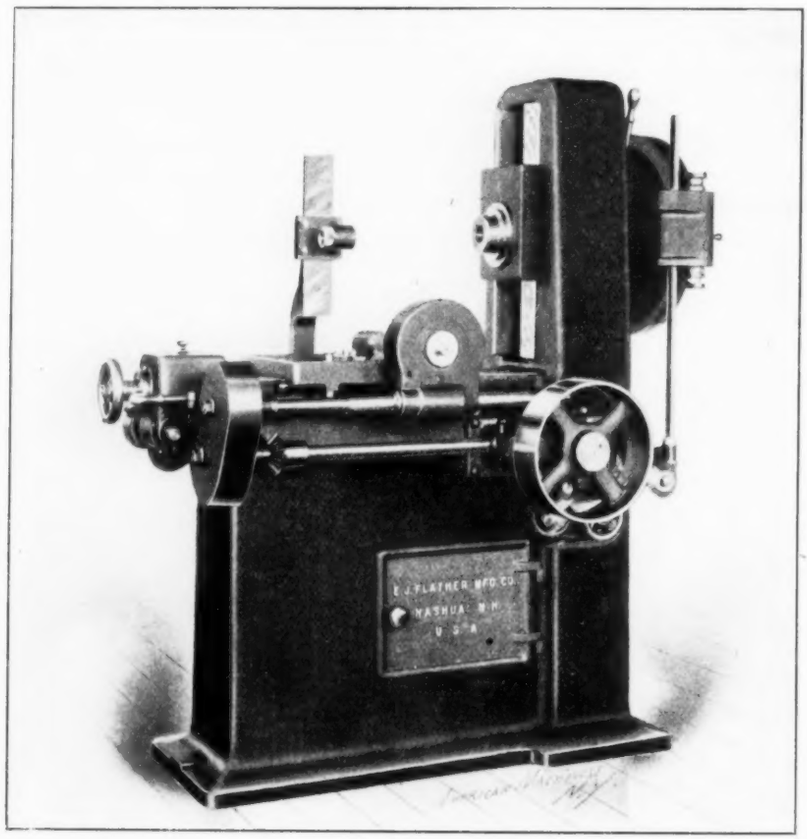
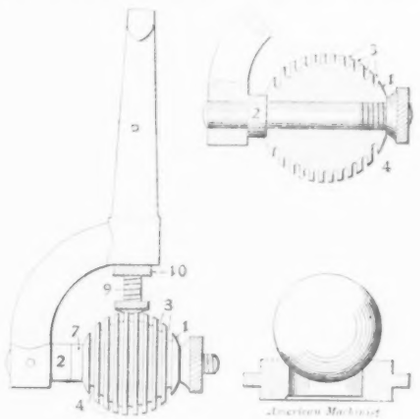



FIG. 1. THE FLATHER AUTOMATIC GEAR CUTTER.

RENEWABLE TOOL FOR BALL VALVE SEATS.

The cut shows a tool recently patented for machining spherical valve seats such as are generally used in oil wells, this tool having originated in connection with that line of work. The cutting edges, as will be seen, are at once renewable when worn, by simply turning the cutter. The central screw above holds the cutter in any position to which it may be set.




RENEWABLE TOOL FOR BALL VALVE SEATS.

THE PHILIPS PRESSED STEEL PULLEY.

The pulley shown in Fig. 1 is the latest of the family of built-up pulleys which the modern materials and the modern tools

and methods have made possible, and it is by no means the least interesting and novel of the lot. The special and most valuable features of the pulley are not revealed at the first glance and may be overlooked if a little attention is not given to it. As a matter of daring and successful invention the rim of the pulley is perhaps the most striking part of it. One, upon seeing the central flange which projects inwardly around the center of the rim, naturally looks for the corresponding joint running around the outside, and when this is not discovered it is very natural to suppose that the photograph or the half-tone has been doctored. In fact, there is no outside seam and the cross-section of the rim at any point is continuous, as seen at *C*. The sheet from which the rim is made is of sufficient width to allow it to turn in to form the stiffening bead at the edge and then extend in along the belt carrying portion of the pulley, thus doubling it, and then turning in towards the center to form the flange to which the arms are attached. Each half of the rim is made long enough to provide material for the lip which is turned in at each end to bolt the halves together. Strips of light channel iron, see *D*, are provided to hold the bolt from turning, so that only one wrench is required. The hub of the pulley is cast with projections to which the arms are riveted, the angles at which the arms are placed providing for effectively resisting both the lateral and the torsional strains to which the pulley may be subjected and the triangular sections of the arms themselves giving them great rigidity. The section at *B* shows how the ends of the arms are pressed into the countersink of the casting, thus avoiding a shearing strain upon the rivets. The shearing strain is avoided also where the arms attach to the rim by the

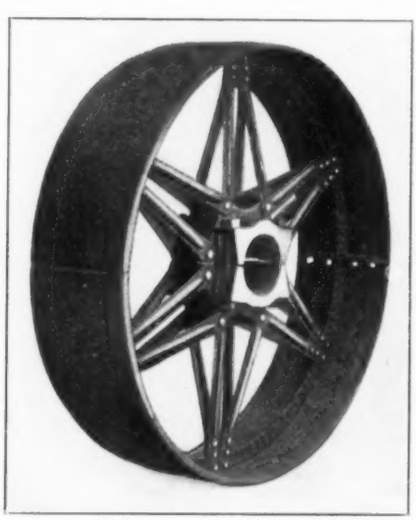


FIG. 1. THE PHILIPS PRESSED STEEL PULLEY.

use of the "dowel" plates, as they are called, shown at *A*, Fig. 2. Bushes are provided for the hub to fit shafts of any size. The pulleys throughout are made of sheet steel of different thicknesses according to the strength and power requirements for the individual pulley. This pulley is the invention of Ferdinand Philips, of Philips, Townsend & Co., pioneers in the wire-nail industry, and is made by the

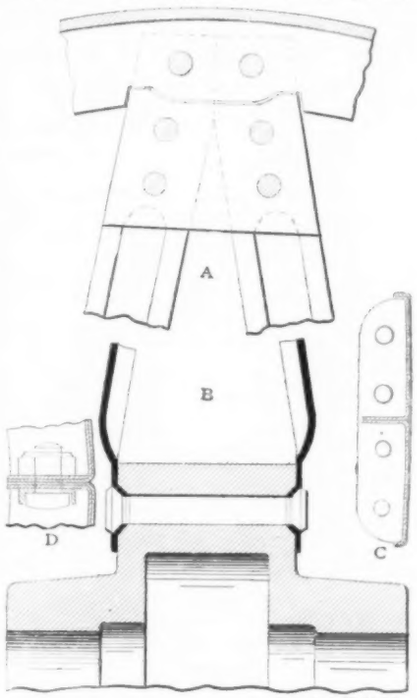



FIG. 2. DETAILS OF PHILIPS PRESSED STEEL PULLEY.

Philips Pressed Steel Pulley Works, Fourth street and Glenwood avenue, Philadelphia.

---

After many years of resistance to the introduction of typesetting machines in the Government printing office, it has at last been decided to install them, and twenty-five Mergenthaler and twenty-eight Lanston Monotype machines are to be put in for trial. It is understood that they are to be used in the printing of public documents, and may finally be used also in getting out *The Congressional Record*. The printers generally have not, at least for some years past, opposed the use of typesetting machines in private offices. They have exerted their influence toward the prevention of their adoption in the Government printing office ostensibly because the machines were not adapted to the work done there.

---

The president of the International Association of Allied Metal Mechanics recently officially protested against the scale of prices for piece work on the new army rifle at the Springfield (Mass.) Armory, as revised by Col. Phipps, the commandant, and on June 24 Secretary Taft issued an order restoring the scale of wages which prevailed before the manufacture of the new rifle was commenced. The Secretary directs that no permanent scale of piecework prices be adopted until after further experience with the manufacture of the new rifle.

### Personal.

H. L. Kinsley, who has been with Manning, Maxwell & Moore for something over five years, and was formerly with the Hop dale Screw Company, will represent the Warner & Swasey Company in the East, commencing July 1.

At the recent first annual dinner of the New York League of Heat & Cold Insulation, T. T. Lyman, chairman of the executive committee and manager of the asbestos department of the H. W. Johns-Manville Company, of New York, was presented with a silver service of fourteen pieces.

Walter H. Whiteside has been appointed general manager of sales for the Allis-Chalmers Company. Mr. Whiteside has the preparation of a wide and varied experience with the Westinghouse Electric & Manufacturing Company, the Hercules Powder Company, Cleveland Electrical Manufacturing Company, and has had to do with many of the largest engineering projects of the day.

---

### Obituary.

Rev. Dr. Edward Frederick Moldenke, father of Dr. Moldenke, secretary of the American Foundrymen's Association, died at Watchung, N. J., June 25, his death having been hastened if not directly caused by worry and grief over the deaths of twenty of his parishioners on the burned steamer "General Slocum." Dr. Moldenke was one of the founders of the University of the Northwest.

George E. Dixon, president of the firm of George E. Dixon & Co., manufacturers of steam and hot-water appliances, was, with his wife, killed in an automobile accident at Chicago, June 26. Mr. Dixon, who was fifty-four years old, was a native of Yorkshire, England, where he was educated in engineering lines, and came to this country in 1881, locating in Chicago four years later. He was a member of the American Society of Mechanical Engineers, joining in 1887.

Hugh D. Meier, formerly assistant editor of *The Horseless Age*, who was instantly killed, May 16, at the St. Louis Exposition by the explosion of a compressed air pipe, had an interesting record for a man so young. He was in his thirtieth year, was born in St. Louis, in his thirteenth year went with his parents to Karlsruhe, Germany, where his elementary education was completed, after which he took a course in mechanical engineering at the Polytechnic School and later studied electrical engineering at Darmstadt. He became draftsman with the Berlin branch of the Worthington Pump Company and after that was associated with the inventor of the Diesel motor, working in the several German offices of the Diesel Company and returning to this country in connection with the same concern. Later he went with the De Dion-Bouton Motorette Company and then joined *The Horseless Age*.

He superintended the erection of three engines in the power-house of the German Tyrolean Alps at the World's Fair, and was about to return to New York when his life work was so suddenly ended.

Vaughan Snider, editor of *The Blacksmith and Wheelwright*, and secretary of the M. T. Richardson Company, died June 19. He was formerly and for many years foreman of a large printing establishment and had been connected with the *Crockery and Glass Journal*. He was a descendant of the inventor of the Snider rifle.

## Business Items.

The Cincinnati Milling Machine Company received the order of the Canadian Westinghouse Electric & Manufacturing Company, Hamilton, Ontario, Canada, for eleven milling machines and two cutter grinders. This is the largest single order for milling machines that has been placed for some time.

The Globe Machine & Stamping Company, 970 Hamilton street, Cleveland, Ohio, on June 15 acquired the good will in business, merchandise, machinery, etc., which has been carried on for the past thirty years by Otto Konigslow, of Cleveland, who will remain with the new company as a director and superintendent. The company does a general machine, jobbing business and builds special machinery, etc.

The Rand Drill Company has been awarded the contract for furnishing two large air compressors to be used in the Central Air Power Plant, eighteen miles below Sault Ste. Marie. They will supply air to operate twenty-five Little Giant rock drills, four 3-ton cableways and four large water pumps. Their combined capacity is 6,600 cubic feet of free air per minute. The work in hand is for constructing and dredging a two-mile channel in the Soo River, wide and deep enough for the navigation of large vessels.

The equipment of factories with electric motors for individual and group drive of machine tools has become such an extensive department of the business of the Crocker-Wheeler Company that it is warranted in going a step further. It is now prepared to give its clients expert advice upon the latest ideas and results in shop practise. To this end it has retained the firm of Dodge & Day, of Philadelphia, and places the services of this firm at the disposal of its customers, giving them gratuitously the benefit of its wide experience and data. The advice and recommendations about which its customers may consult this firm need not be confined to electrical details, but may include all problems of shop equipment and management.

## Manufacturers.

The Hagge-Fox handle factory, Dubuque, Ia., has been much damaged by fire.

The Binghamton (N. Y.) Pulp Company, recently organized, will build a plant.

Alvin Underwood will erect a power-house at Pawnee, Ill., for his electric light plant.

It is stated at Sebring, O., that the Buckeye Forge Works will build an addition to its plant.

The York (Pa.) Shoe Manufacturing Company will enlarge its factory and install new machinery.

A water-works system for Truxton, N. Y., was discussed at a meeting held in Frank L. Hilton's office.

Fire has damaged the plant of the Allegheny (Pa.) Light & Power Company, on Braddock street.

The factory of the Northwestern Cooperage Company, in St. Paul, Minn., or vicinity, has been burned.

The Ames-Bonner Company, Toledo, O., manufacturer of brushes, intends to build a large new factory.

Tonks Brothers, pearl works, button manufacturers, Newark, N. J., have contracted for a factory addition.

A four-story addition is about to be built to the factory of August Mecky, bicycles, Tioga, Philadelphia, Pa.

The Vought-Berger Company, manufacturer of telephones, La Crosse, Wis., may enlarge the capacity of the plant.

The hoist of a mine near Part City, Utah, of the Ontario Silver Mining Company, Salt Lake City, has been burned.

The Mutual Electric & Machine Company, Wheeling, W. Va., is understood to contemplate building a new plant.

Plans are being prepared for a two-story factory, 50x150 feet, for the Minneapolis (Minn.) Showcase Company.

Factory improvements are about to be made in Philadelphia for the Hale & Kilburn Manufacturing Company, furniture.

The Eureka Company, manufacturer of carriages and washing machines, Rock Falls, Ill., contemplates enlarged facilities.

The Smith-Eggers Company, Cincinnati, O., carriages, was lately reported negotiating for a site at that place for a new factory.

Pellston, Mich., expects to have "the largest broom handle plant in the world," to be built by Tindle & Jackson, of Buffalo, N. Y.

The Lowe Manufacturing Company proposes to practically double the capacity of its 10,000-spindle cotton mill in Huntsville, Ala.

Edgar A. Wyman, of Bangor, Me., who is operating a canning factory at East Corinth, expects to establish one at Brewer for use next year.

The Pintsch Compressing Company, New York city, is preparing to establish a gas plant at South Brookland, a Washington, D. C., suburb.

The Fibre Demijohn Company, of New Jersey proposes to build a plant at Stroudsburg, Pa., and manufacture fine prescription wares and panels.

Plans have been made for alterations to the factory of J. H. Wallace & Bro., wool, etc., at Juniper street and Snyder avenue, Philadelphia.

The Fairmount (Ind.) Glass Works have been receiving bids on a plant which they will erect at Indianapolis to be operated with producer gas.

The Safety Steel Derrick Company, Bowling Green, O., is moving its plant to Deshler, O. The intention is to manufacture other oil well machinery.

Plans have been made for a group of leather factory buildings, to be erected at Delaware avenue and Vankirk street, Philadelphia, for E. K. Janney & Son.

The American Casting Company, whose plant at East Birmingham, Ala., was destroyed by fire a few weeks ago, will rebuild the works at once on a larger scale.

A factory of the Michigan Peat Company is to be erected near Eaton Rapids. The main building will be 60x200 feet, and the boiler- and engine-house 40x80 feet.

It is reported from Stroudsburg, Pa., that a Syrian colony, numbering 1,000 or more, will be established in Middle Smithfield Township. A silk factory is to be built.

The Board of Trade, Ossining, N. Y., knows of a typewriter company having an office in New York city, and which thinks of locating a large factory somewhere on the Hudson.

A permit has been granted for a 54x200-foot, two-story and basement carpet factory at the northwest corner of Butler and Jasper streets, Philadelphia, for Charles P. Cochrane.

Wickwire Brothers, of Cortland, N. Y., manufacturers of wire cloth, are adding two buildings to their plant, one 75x125 feet, three stories; the other, 60x60 feet, two stories.

An official of the Reliance Gas Machine & Manufacturing Company, Davenport, Ia., is quoted as saying that the company has started to erect extensive buildings at Bettendorf.

Kansas City expects to have another packing plant, to be built by the American Dressed Beef & Provision Company, which has been incorporated with John Ruddy, of Chicago, as president.

The new yarn mill, the construction of which at Gilboa is being started by a company comprising Wm. E. Hayward, of East Douglas, Mass., and others, will, it is said, have a machine shop.

A silk mill fire at Paterson, N. J., has caused damage to the following concerns: I. A. Hall & Co., David Beckett Silk Company, Post & Sheldon Silk Company, Henry Doherty, John Hollbach & Co.

The Pittsburg (Pa.) Stove & Range Company plans concentrating its individual plants, with the exception of the plant at New Castle, into one works to be built on Preble avenue, Allegheny.

The Gill Bros. Company, Steubenville, O., manufacturer of lamp chimneys, etc., will at once build a factory at Toronto, O., to employ at least 300 men. Electrical appliances will be used wherever possible.

At Hartford, Conn., committees representing the common council, the board of trade and Hartford Business Men's Association are projecting an industrial building in which space and power can be leased.

There is a project to build a factory at Marion, Ind., to make a fuel of which it is locally affirmed that 99 per cent. will be a soil found in certain places. Grant County soil is being tested for the purpose.

Waltham, Mass., men are interested in a copper and lead mining property in Wyoming, and the building of a concentrating plant is proposed. Hon. A. R. Kelly, presumably of Waltham, is prominent in the matter.

Machinery has been ordered for a new sawmill at Turtle Bay by the Redding (Cal.) & Big Bend Lumber Company. This is the forerunner of a box factory which will probably be installed next season by the same company.

The directors of the Richmond Spinning Company, Chattanooga, Tenn., propose to increase the capital stock from $250,000 to $350,000 and to erect a hosiery mill. The plan will probably not be carried out before election.

A lead pencil wood factory is to be established at Nashville, Tenn., by Friedlander & Co., who are reported to be a New York city firm. The factory will be an enlargement of one to be removed from another place in Tennessee.

Edmund F. Bard, agent of Fred M. Steele, a Chicago capitalist, and Madison Cooper, a refrigerator engineer and architect, of Minneapolis, Minn., have been at Benton Harbor, Mich., to plan for the erection of a big cold storage plant.

A factory will be built at Memphis, Tenn., for making brick of sand and lime by a new process. The officers of the company are: A. Caldwell, president; H. P. Johnson, vice-president; Bolton Smith, secretary, and S. M. Apperson, general manager.

The Yale & Towne Manufacturing Company has let the contract for an additional building, 57x75 feet, at its works at Stamford, Conn. The company will enlarge its cabinet lock department, probably by an addition distinct from the first-mentioned.

A meeting has been held by merchants and farmers of the vicinity of Grand Prairie, Tex., to organize for the purpose of building a new cotton gin. The following were elected as a board of directors: S. P. Lively, John Fagan, Sr.; P. McNatt, R. L. Cox and J. E. Payne.

It is believed that a soap factory will ultimately be built in connection with the cotton seed oil mill about to be erected at Atlanta, Ga., by the Buckeye Cotton Oil Company, Cincinnati, O., which is said to be controlled by the Proctor & Gamble Company, manufacturer of Ivory soap.

The South Atlantic Car & Manufacturing Company, Waycross, Ga., will put in additional machinery. The paid-in capital stock of the company was $97,000, and its net profits for nine months are reported at $69,000. The directors have voted to increase the capital stock to $125,000.

The Lakeview Manufacturing Company, recently chartered with $50,000 capital, has purchased the Fayetteville (N. C.) Cotton Mills, an idle plant, and will modernize and probably enlarge the same. W. L. Holt, E. H. Williamson and L. A. Williamson, well-known mill men of Fayetteville, were the incorporators.

The Fite Machine Company is a new industry which has opened at 7 South Church street, Charlotte, N. C. The members of the firm are C. V. Fite, J. M. Springs and R. H. Stowe. The business is under the active management of C. V. Fite, an expert machinist. The concern has a plant equipped to build and repair machinery. A specialty is made of experimental work.

The Marion (Ind.) Commercial Club has a proposition from a large tool and cutlery manufacturing company in the West, which, it is said, cannot fill more than half the orders coming in, and would like to locate in the gas belt, enlarging its capacity. A palace car company also talks of moving to Marion, and, if so, would establish an artificial gas plant to supply most of its fuel.

A factory is to be erected at Naugatuck, Conn., by the Naugatuck Chemical Company, recently organized under the laws of New York State, with a capital of $100,000. The company was induced to locate there through the influence of W. T. Rodenbach, warden of the borough, who is a stockholder. The president is E. C. Benedict, of New York. The business will be the manufacture of acids.

The Detroit Motor Car Company has been incorporated under the laws of Michigan, with a capital stock of $400,000, by W. W. Patterson, H. J. Newman, I. R. Sexton, Philip Heseltine and Frank E. Miles. The company is in the market for a complete automobile factory equipment and is interested in machine tools, automobile parts, drop forgings, etc. The office is at 1102 Majectic Building, Detroit, Mich.

The Moline (Ill.) Plow Company has arranged to invest $400,000 in new shops, employ about 1,000 men in Stoughton, Wis., and manufacture such agricultural implements as have heretofore been purchased by the company from other factories. A tract of eleven acres within the city is being secured. The Moline Plow Company absorbed a vehicle company at Stoughton and has already 300 mechanics at work manufacturing vehicles.

The Findlay (O.) Foundry & Machine Company is said to have practically completed plans for the purchase of the Van Buren, Heck & Marvin plant. The company has been incorporated and expects to take possession of the plant about August 1. The Van Buren, Heck & Marvin Company will devote its attention after that time to the manufacture of the Buckeye traction ditcher, and is building a new factory. The officers of the Findlay Foundry & Machine Company are: President, E. C. Taylor; vice-president, W. E. Gorrell; secretary and general manager, C. F. Spiece; treasurer, E. H. Thomas.

The American Duplex Steel Company is establishing a plant at Bradford, Pa., to employ the Hunter process of converting cast iron into malleable iron and steel. The annealing furnaces are said to be covered by basic patents. The company is prepared to make all kinds of castings, including gear wheels, cylinders, valves, fittings, agricultural and hydraulic castings, tempered dies, hammers, axes, hatchets, railroad and mining tools and oil well supplies. A. J. Paris, Jr., of New York city, was active in starting the company and is secretary and general manager. J. F. Hammell is superintendent. This concern has organized another company for the manufacture of axes, hatchets and other edge tools in a city within fifty miles of Bradford and has a number of applications under advisement for the use of the process and the organization of companies for the manufacture of specialties in malleable iron and steel.

## Miscellaneous Wants.

*Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Want equipment for machine shop; only first-class machines. Theo. Coles, Oneida, N. Y.

Automatic machinery designed; working drawings. Geo. M. Mayer, M. E., 1131 Monadnock, Chicago, Ill.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Wanted—Second-hand vertical boring mill, 60 or 72 in.; must be in good condition. Ft. Scott Mfg. Co., Ft. Scott, Kan.

Auto. machinery of all kinds designed and built; hardened and ground work, flat or circular. Wiebking, Hardinge & Co., Chicago.

Addressing machines without type; high speed; run by motor or foot power; write for the picture book. B. F. Joline & Co., 123 Liberty st., New York.

Agents wanted in all parts of the country to introduce a new tool, on liberal commission. Address Crane & Richardson, 112 Water st., Boston, Mass.

Swiss merchant wishes to represent manufacturers of machines and tools in tin ware industry. Address Z. R., 4292, care Rudolphe Mosse, Zurich, Switzerland.

Wanted—To correspond with New England parties who will manufacture small machine tool; $100 profit; used in automobile manufacturing. Address Box 93, AMER. MACH.

Experienced M. E., having improved machine tool in great demand, desires to associate with party with means to manufacture; moderate capital required. Box 97, AM. M.

"Railroad Pointers"—A handy vest-pocket booklet about tractive power, grades, curves, types of locomotives, cars, air brakes, etc., etc.; 10c. coin or stamps. The Derry-Collard Co., 257 Broadway, New York.

Wanted—To build, by day labor or contract, medium weight or heavy machines or parts for machines; ideas developed and machines built; our plant is new and up to date; 36 years' experience. Address M., care AMERICAN MACHINIST.

New Turbine.—Dr. F. Stolze, lecturer at the Berlin Royal University (add. 188 uhland str., Charlottenberg, Berlin), wishes to find private capitalists or company who would interest themselves in his patented new hot air turbine; entirely new system which will exceed anything already known in the way of economy, power and smallness of its dimension.

## For Sale.

U. S. patent No. 760,809, reciprocating steam engine for sale. Further information by S. Hjort Schmidt, 65 Jefferson st., Perth Amboy, N. J.

For Sale—An old-established pattern shop; excellent reputation; centrally located in New York city; equipped with up-to-date woodworking machinery; splendid opportunity for energetic party; selling because another line requires more attention. Address "Patterns," care AMERICAN MACHINIST.

## Wants.

*Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.*

## Situations Wanted.

*Classification indicates present address of advertiser, nothing else.*

CONNECTICUT.

Wanted—An experienced draftsman to detail machinery and factory designs; a good position; state particulars. Address Box 86, AMERICAN MACHINIST.

Competent machine shop foreman desires change; 20 years' practical experience; thorough mechanic; reference as to character and executive ability. Box 80, AMER. MACH.

NEW JERSEY.

Position as engineer, superintendent or assistant, by technical graduate of 15 years' general experience; last 4 years in charge of works employing 300 hands on condensers, pumps, etc., and evaporators. Box 74, AM. M.

NEW YORK.

Mechanical draftsman, with extensive experience, desires a position. Box 96, AM. M.

Mechanical draftsman desires steady position; 7 years' experience; familiar with shop work. Box 91, AMERICAN MACHINIST.

Mechanical draftsman, 6 years' experience, desires position; 4 years' practical shop experience. Box 90, AMERICAN MACHINIST.

Presently occupied general manager and systematizer open for change; will assume your entire business cares. Box 84, AM. M.

Superintendent; expert on designing and constructing electric heating and cooking appliances. Otto Zimmerman, 2254 Bathgate ave., N. Y. City.

Progressive mechanical superintendent desires change; good executive and manager of help; will make your plant pay. Box 92, AMERICAN MACHINIST.

Toolmaker, with many years' experience in designing and making of screw machine tools, wants to make a change. William Tottrup, 227 Havemeyer st., Brooklyn, N. Y.

Expert mechanic, progressive, 20 years' experience in interchangeable and general machinery, first-class reference as general foreman, desires responsible position. Box 94, AMERICAN MACHINIST.

OHIO.

Experienced case-hardener, steady sober man, 36, wants position. H. J. Heckett, Canton, Ohio.

Situation wanted as superintendent; 8 years' experience manufacturing bicycles; 12 years manufacturing general machinery and machine tools; well up in modern machine shop practise, cost-keeping, cost reduction, factory system, labor-saving tools for duplicate reproduction and general factory economics; now with large machine tool works, but desire to make a change soon. Address Box 95, AMERICAN MACHINIST.

PENNSYLVANIA.

A young man desires position as shipping clerk or assistant bookkeeper and stenographer with reliable firm; has had experience; can give references. Address Box 87, AMERICAN MACHINIST.

Designer with extensive experience on special machinery, jigs and fixtures for economic

manufacturing and familiar with presses and dies for sheet metal working, wants to get busy in the Central West. Box 89, AM. M.

WISCONSIN.

Young draftsman, good on tracing and details, wants position. Box 83, AMER. MACH.

Mechanical draftsman wishes situation; 4 years' experience in machine-tool line. Box 69, AMERICAN MACHINIST.

## Help Wanted.

*Classification indicates present address of advertiser, nothing else.*

CANADA.

Wanted—First-class operator for Jones & Lamson lathe. Apply Ross Rifle Co., Quebec, Canada.

Brass Finishers—A first-class steam gage maker, also injector hand and Fox lathe hands. Box 98, AMERICAN MACHINIST.

Wanted—Mechanical engineer and practical machinist, thoroughly competent to act as superintendent. Apply Box 526, AM. MACH.

Wanted—A competent foreman to take charge of the erection and installation of interlocking plants; give experience and reference. Box 88, AMERICAN MACHINIST.

ILLINOIS.

Wanted—Good salesmen; must be mechanical engineers; good proposition to first-class men. Address Hawley Down Draft Furnace Co., Chicago.

MASSACHUSETTS.

Wanted—At once, draftsmen and toolmakers for exceptionally fine and accurate instrument work; only first-class men need apply. Box 85, AMERICAN MACHINIST.

Wanted—Foreman for machine shop and repairs in large manufacturing plant; requires a first-class machinist; experienced as foreman. Address "Mass," care AM. MACH.

Wanted—Experienced foreman; a young man with executive ability and thorough knowledge of the brass finishing business, as foreman in a shop manufacturing plumbers' supplies and hose connections. Address "Boston," care AMERICAN MACHINIST.

NEW JERSEY.

Wanted—Several capable toolmakers. Write Trenton Watch Co., Trenton, N. J., stating age, experience, etc.

NEW YORK.

Wanted—First-class metal patternmakers, experienced on valves and fittings preferred; in replying state age, experience, whether married or single and wages expected. Box 63, AMERICAN MACHINIST.

Assistant superintendent and, a buyer wanted for successful co-operative metal manufacturing company; investment $2,000 or $3,000, satisfactorily secured; high rating Bradstreet's and Dun's. Box 99, AM. MACH.

A superintendent, mechanical engineer and a bookkeeper wanted for old, prosperous, co-operative company, manufacturing engines, motor vehicles; investment required, perfectly secured. Box 100, AMERICAN MACHINIST.

OHIO.

Wanted—First-class man as speed boss, also to set rates, Taylor system; good position for right man; references required. Box 10, AMERICAN MACHINIST.

Wanted—Draftsman, technical graduate, experienced in making tool design and in up-to-date drawing room and shop practice; good position; references required. Box 9, AMERICAN MACHINIST.

A large Ohio factory, engaged in the manufacture of small interchangeable parts, is looking for a thorough, up-to-date mechanic, who is original in his ideas and who has had all-around machine experience; he must be a man who is not afraid to work and can personally demonstrate the practicability of suggestions and ideas of others as well as his own, with the object in view of improving and cheapening the product by having more improved and up-to-date methods of manufacturing same; it is a good opportunity for an ambitious, energetic man who wants to show his ability where it will be appreciated. Apply immediately to Box 101, AM. MACH.

Wanted (for master mechanic)—A first-class man, between 35 and 45 years of age, to take charge of the mechanical departments of our factory; one having some technical education preferred; applicant must have a thorough knowledge of methods used in manufacturing small machines requiring duplication of parts, enough executive ability to properly handle men and foremen of departments under his supervision, and be capable of bringing tools, jigs, fixtures and machinery to the highest point of efficiency; a first-class position for a man of energy with ability to produce results; in applying, give age, references, experience in full and salary desired. Toledo Computing Scale Co., Toledo, Ohio.

PENNSYLVANIA.

The Monotype Company maintains a school to train young men to meet the constantly increasing demand for operators of its type casting and composing machine. These operators have done so well that it receives more applications for places than can be filled. In making selections these qualifications carry most weight: common sense, type foundry experience, printing office experience, automatic machinery experience. Full particulars will be furnished to inquirers who furnish the same information about themselves. The Lanston Monotype Machine Co., 1231 Callowhill st., Philadelphia, Pa.

WEST OF MISSISSIPPI.

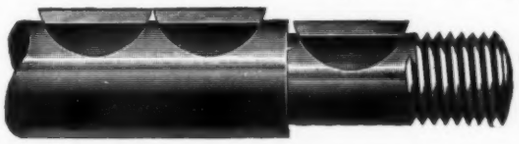
Three first-class machinists; general hands; one must thoroughly understand operation of roll grinding and corrugating machines; steady work; "open shop." Address Box 488, AMERICAN MACHINIST.

## Alphabetical Index to Advertisers.


| | PAGE |
|---|---|
| Acme Machinery Co | 18 |
| Adams Co., The | 81 |
| Albro-Clem Elevator Co | 72 |
| Almond, T. R | 70 |
| Alteneder & Sons, Theo | 87 |
| American Gas Furnace Co | 96 |
| American Pulley Co | 74 |
| American Tool Works Co | 8 |
| Armstrong Bros. Tool Co | 78 |
| Auburn Ball Bearing Co | 80 |
| Automatic Machine Co | 80 |
| Backus Water Motor Co | 70 |
| Baird & Co., Henry Carey | 99 |
| Baird Machinery Co | 99 |
| Baker Brothers | 69 |
| Ball Bearing Co | 18 |
| Bantam Mfg. Co | 68 |
| Barker & Co., Wm | 67 |
| Barnes Co., B. F | 75 |
| Barnes Co., W. F. & John | 14 |
| Barnett Co., G. & H...4th Cover | |
| Bartlett, E. E | 94 |
| Bates Machine Co | 100 |
| Baush, W. H | 101 |
| Bay State Stamping Co | 67 |
| Beaman & Smith Co., The | 15 and 82 |
| Becker-Brainard Milling Machine Co | 13 |
| Belmer Machine Tool Co | 67 |
| Bertram & Sons Co., Ltd., John | 9 |
| Beskin Mfg. Co | 86 |
| Besly & Co., Chas. H | 97 |
| Bethlehem Fdry. & Mch. Co. | 68 |
| Betts Machine Co | 6 |
| Bickford Drill & Tool Co | 10 |
| Bignall & Keeler Mfg. Co | 99 |
| Bilgram, Hugo | 18 |
| Billings & Spencer Co.4th Cover | |
| Binsse Machine Co | 18 |
| Blaisdell Machinery Co | 91 |
| Blanchard Mach. Co...18 and | 93 |
| Bliss Co., E. W | 94 |
| Boston Gear Works...2 and | 101 |
| Boynton & Plummer | 98 |
| Bradford Machine Tool Co | 5 |
| Bridgeport Chain Co | 91 |
| Bristol Co | 4th Cover |
| Brown & Co., R. H | 82 |
| Brown Hoisting Mach. Co | 91 |
| Brown & Sharpe Mfg. Co | 55 and 4th Cover |
| Buffalo Forge Co | 4th Cover |
| Builders Iron Foundry..3d Cover | |
| Bullard Machine Tool Co | 16 |
| Burt Mfg. Co | 89 |
| Butler, A. G | 80 |
| Caldwell & Son Co., H. W | 98 |
| Canton Fillet Co | 83 |
| Carborundum Co., The | 75 |
| Card Mfg. Co., S. W | 17 |
| Carpenter Tap & Die Co., J. M. | 68 |
| Case Mfg. Co | 91 |
| C & C Electric Co | 84 |
| Chambersburg Engr. Co | 69 |
| Chattanooga Machinery Co | 74 |
| Chicago Rawhide Mfg. Co | 72 |
| Christensen, N. A | 93 |
| Cincinnati Mach. Tool Co | 89 |
| Cincinnati Milling Mach. Co. | 7 |
| Cincinnati Planer Co | 9 |
| Cincinnati Screw & Tap Co | 69 |
| Cincinnati Shaper Co | 102 |
| Clayton Air Compressor Wks. | 98 |
| Cleveland Auto. Mach. Co | 79 |
| Cleveland Cap Screw Co | 69 |
| Cleveland Crane & Car Co | 91 |
| Cleveland Gear Works | 72 |
| Cleveland Pneumatic Tool Co. | 93 |
| Cleveland Stone Co | 90 |
| Cleveland Twist Drill Co | 4th Cover |
| Clough, R. M | 72 |
| Coates Clipper Mfg. Co | 80 |
| Coes Wrench Co | 67 |
| Colburn Machine Tool Co | 78 |
| Commercial Electric Co | 86 |
| Cook Co., Asa S | 71 |
| Cooper-Wigand-Cooke Co | 90 |
| Crane Co | 96 and 99 |
| Cregar Agency, J. W | 101 |
| Cresson Co., Geo. V | 96 |
| Crocker-Wheeler Co | 85 |
| Crosby Stm. Gage & Valve Co. | 17 |
| Crucible Steel Forge Co | 90 |
| Cumberland Steel Co | 71 |
| Curtis & Co. Mfg. Co | 91 |
| Curtis & Curtis Co | 71 |
| Cushman Chuck Co | 82 |
| Dallett Co., Thomas H | 68 |
| Desmond-Stephan Mfg. Co | 73 |
| Detrick & Harvey Machine Co. | 89 |
| Detroit Twist Drill Co | 82 |
| Diamond Drill & Mch. Co | 81 |
| Diamond Machine Co...3d Cover | |
| Dill Machine Co., T. C | 83 |
| Dixon Crucible Co., Joseph | 90 |
| Dreses Machine Tool Co | 76 |
| Earle Gear & Mach. Co | 72 |
| Electric Controller & Supply Co | 85 |
| Elmes Engr. Works, Chas. F. | 67 |
| Errington Auto. Tap & Die Co. | 83 |
| Evans Friction Cone Co | 73 |
| Excelsior Needle Co | 87 |
| Fairbanks Co | 100 |
| Fairbanks Machine Tool Co | 71 |
| Falkenau-Sinclair Mach. Co | 69 |
| Faneuil Watch Tool Co.3d Cover | |
| Farrel Fdry. & Machine Co | 90 |
| Fawcus Machine Co | 73 |
| Federal Mfg. Co | 65 |
| Fellows Gear Shaper Co | 72 |
| Firth-Sterling Steel Co | 90 |
| Flather & Co | 79 |
| Foos Gas Engine Co | 70 |
| Foote, Pierson & Co | 99 |
| Fosdick Machine Tool Co | 15 |
| Foster Co., The Walter H | 66 |
| Foster-Kimball Co | 72 |
| Franklin Mfg. Co | 66 |
| Frick Co | 70 |
| Garvin Machine Co., The | 101 |
| Gay & Ward, Inc | 61 |
| General Electric Co | 84 |
| General Pneumatic Tool Co | 93 |
| Geometric Drill Co | 81 |
| Gisholt Machine Co | 83 |
| Gleason Works..1 and 4th Cover | |
| Globe Mach. & Stamping Co | 98 |
| Goldschmidt Thermit Co | 78 |
| Gorton Machine Co., Geo | 75 |
| Gould & Eberhardt | 59 |
| Graham Mfg. Co | 80 |
| Grant Gear Works | 72 |
| Gray Co., G. A | 18 |
| Greaves, Klusman & Co | 75 |
| Greene, Tweed & Co | 73 |
| Greenwald Co., I. & E | 72 |
| Hammacher, Schlemmer & Co. | 65 |
| Hampden Corundum Wheel Co. | 82 |
| Harrington, Son & Co., Inc., Edw | 94 |
| Harris Oil Co., A. W | 99 |
| Hartford Blower Co | 68 |
| Hartford Steam Boiler Insp. & Ins. Co | 70 |
| Hendey Machine Co | 63 |
| Heppenstall Forge & Knife Co. | 70 and 101 |
| Herron & Bury Mfg. Co | 91 |
| Hess-Bright Mfg. Co | 66 |
| Hill, Clarke & Co....57 and | 101 |
| Hill, Louis A | 80 |
| Hilles & Jones Co | 100 |
| Hisey-Wolf Machine Co | 69 |
| Hoefer Mfg. Co | 9 |
| Hoggson & Pettis Mfg. Co | 82 |
| Holtzer-Cabot Elec. Co | 86 |
| Horsburgh & Scott Co..4th Cover | |
| Horton & Son Co., E | 82 |
| Howard Iron Works | 67 |
| Hunt Co., C. W | 99 |
| Hunt & Co., Robt. W | 99 |
| Hyatt Roller Bearing Co | 71 |
| Ingersoll Milling Mach. Co | 80 |
| Ingersoll-Sergeant Drill Co | 93 |
| Iroquois Machine Co | 90 |
| Jacobs Mfg. Co | 82 |
| Jacobson Mach. Mfg. Co | 70 |
| Jantz & Leist Electric Co | 86 |
| Jeffrey Mfg. Co., The | 101 |
| Jenkins Brothers | 96 |
| Johnson Machine Co., Carlyle. | 99 |
| Jones & Lamson Machine Co. | 12 and 18 |
| Kent & Co., Edwin R | 90 |
| Keuffel & Esser Co | 87 |
| Keystone Electric Co | 86 |
| Landis Tool Co | 57 |
| Lane Mfg. Co | 91 |
| Lang Co., G. R | 94 |
| Lapointe Machine Tool Co | 9 |
| Le Blond Machine Tool Co., R. K | 4th Cover |
| Le Count, Wm. G | 82 |
| Link-Belt Engineering Co | 95 |
| Lodge & Shipley Mch. Tool Co. | 4 |
| Long & Allstatter Co., The | 90 |
| Lunkenheimer Co., The | 96 |
| McCabe, J. J | 71 and 100 |
| McCrosky Mfg. Co., F. B | 68 |
| McGeorge & Sons | 90 |
| Marshall & Huschart Mch. Co. | 101 |
| Meadville Vise Co | 76 |
| Meisel Press & Mfg. Co. | 72 and 99 |
| Merrell Mfg. Co | 74 |
| Merritt & Co | 83 |
| Mich. College of Mines | 78 |
| Mietz, A | 70 |
| Miner & Peck Mfg. Co | 94 |
| Modern Tool Co | 82 |
| Morse Chain Co | 94 |
| Morse Twist Drill & Mach. Co. | 17 |
| Mueller Mach. Tool Co | 71 |
| National-Acme Mfg. Co | 102 |
| National Separator & Mahine Co | 83 |
| New Britain Machine Co | 74 |
| New Era Gas Engine Co | 70 |
| New Haven Mfg. Co | 71 |
| New Process Raw Hide Co | 72 |
| Newton Mach. Tool Wks., Inc. | 11 |
| Ney, R. W | 93 |
| Nicholson & Co., W. H | 75 |
| Nicholson File Co | 17 |
| Niles-Bement-Pond Co | 100, 103, 104, 105 and 106 |
| Nolte Brass Co | 74 |
| Northampton Emery Wheel Co | 73 |
| Northern Electrical Mfg. Co. | 85 |

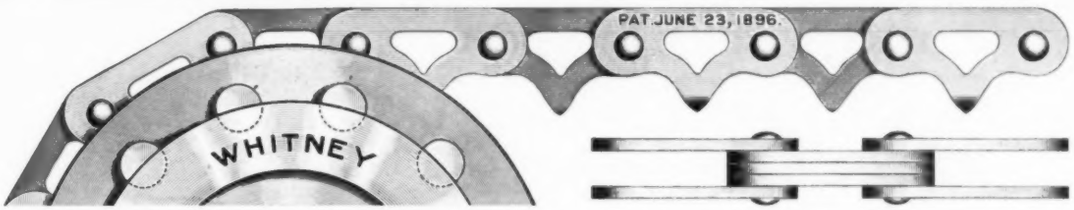
## KEY AND CUTTER DEPARTMENT.

Keys and Cutters for The Woodruff Patent System of Keying.



No. 16 Cutter Full Size.

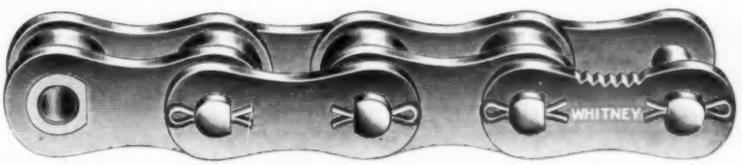
THE WHITNEY MFG. CO.



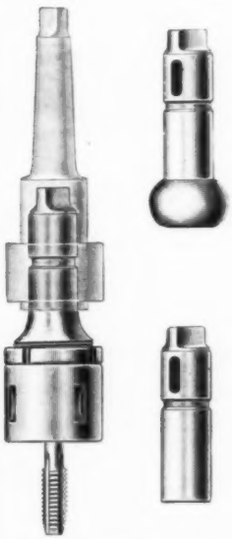

## CHAIN DEPARTMENT.

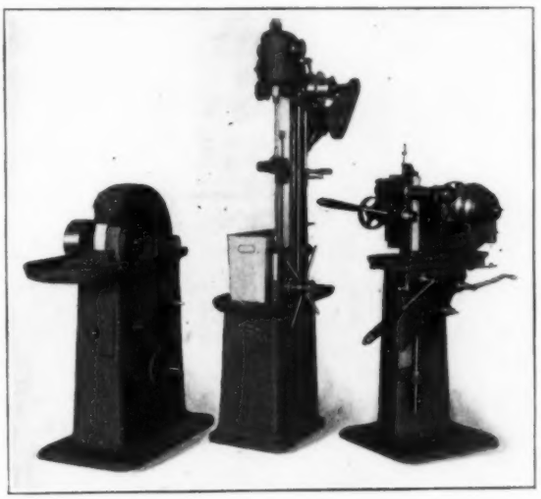
Roller Chains—Block Chains, "Wizard" Chains.

New Construction, Cotter Detachable, Patent Pending.




THE WHITNEY MFG. CO.





## MACHINE DEPARTMENT.

Hand (feed) Milling Machines,

20-inch Water Tool Grinders,

Presto Drill Chucks, Collets and Friction Tapping Devices,

Vertical Automatic Drilling Machines (for long holes).

THE WHITNEY MFG. CO.

FOREIGN AGENTS.

C. W. Burton, Griffiths & Co., Great Britain.
Schuchardt & Schutte, Germany, Austria, Holland, Russia and Scandinavia.
Fenwick Freres & Co., France, Belgium, Italy, Switzerland, Spain and Portugal.

# THE WHITNEY MFG. COMPANY,

HARTFORD, CONN., U. S. A.

| | PAGE |
|---|---|
| Northern Engineering Works. | 91 |
| Norton, A. O. | 78 |
| Norton Emery Wheel Co. | 79 |
| Norton Grinding Co. | 77 |
| Nuttall Co., R. D. | 72 |
| O. K. Tool Holder Co. | 94 |
| Olds Gasoline Engine Works. | 70 |
| Oliver Machinery Co. | 74 |
| Parker Co., Chas. | 80 |
| Patterson, Gottfried & Hunter, Ltd. | 66 |
| Pawling & Harnischfeger. | 91 |
| Paxson Co., J. W. | 70 |
| Penn Pattern & Model Works. | 86 |
| Perkins Machine Co. | 95 |
| Philadelphia Bourse. | 71 |
| Philadelphia Gear Works. | 72 |
| Phila. Pneumatic Tool Co. | 92 |
| Phoenix Mfg. Co. | 80 |
| Phosphor Bronze Smelting Co. | 86 |
| Pittsburg Blue Print Co. | 87 |
| Pond Mach. & Foundry Co., L. W. | 99 |
| Poole Co., J. Morton. | 74 |
| Potter & Johnston Mach. Co. | 63 |
| Power & Speed Controller Co. | 81 |
| Pratt Chuck Co. | 82 |
| Pratt & Whitney Co. | 2 and 3 |
| Prentiss Tool & Supply Co. | 100 |
| Rand Drill Co. | 92 |
| Ransom Mfg. Co. | 80 |
| Reed Co., F. E. | 71 |
| Reed Mfg. Co. | 80 |
| Reeves Pulley Co. | 91 |
| Regal Gasoline Engine Co. | 70 |
| Reliance Machine & Tool Co. | 91 |
| Remy Electric Co. | 70 |
| Rich, J. & G. | 87 |
| Rivett-Dock Co. | 3d Cover |
| Robbins & Myers Co., The. | 86 |
| Rochester Die Shaper Co. | 69 |
| Rogers, Boat, Gage & Drill Works, John M. | 78 |
| Royersford Fdry. & Mach. Co. | 69 |
| Safety Emery Wheel Co. | 68 |
| Saunders' Sons, D. | 75 |
| Sawyer, Ezra. | 73 |
| Sawyer Gear Works. | 72 |
| Schieren & Co., Chas. A. | 70 |
| Schumacher & Boye. | 9 |
| Schwerdtle Stamp Co. | 98 |
| Scranton & Co., The. | 72 |
| Sebastian Lathe Co. | 78 |
| Sellers & Co., Inc., William. | 18 |
| Seneca Falls Mfg. Co. | 80 |
| Shultz Belting Co. | 18 |
| Sibley Machine Tool Co. | 67 |
| Simonds Mfg. Co. | 72 |
| Skinner Chuck Co. | 82 |
| Slocomb Co., J. T. | 68 |
| Smith & Mills. | 74 |
| Sprague Electric Co. | 85 |
| Springfield Machine Tool Co. | 97 |
| Standard Connecting Rod Co. | 10 |
| Standard Engr. Works. | 80 |
| Standard Gauge Steel Co. | 73 |
| Standard Pressed Steel Co. | 91 |
| Standard Tool Co. | 97 |
| Starrett Co., L. S. | 87 |
| Steckenreiter Mfg. Co. | 87 |
| Steel Set Diamond Co. | 90 |
| Steptoe Shaper Co., John. | 73 |
| Stitt, Frederick S. | 80 |
| Stoever Foundry & Mfg. Co. | 86 |
| Straley, Hasbrouck & Schloeder. | 80 |
| Struthers-Wells Co. | 10 |
| Stuart's Foundry & Mach. Co. | 4th Cover |
| Sturtevant Co., B. F. | 13 |
| Superior Tap Co. | 68 |
| Taunton Locomotive Mfg. Co. | 87 |
| Thompson & Son Co., Henry G. | 74 |
| Toomey, Frank. | 99 |
| Triumph Electric Co. | 86 |
| Trump Brothers Machine Co. | 82 |
| Underwood & Co., H. B. | 69 |
| Vandyck Co., J. R. | 9 |
| Vitrified Wheel Co. | 83 |
| Walker & Co., O. S. | 98 |
| Wallace Supply Co. | 100 |
| Ward & Sons, Edgar T. | 90 |
| Warner & Swasey Co. | 75 |
| Warner Instrument Co. | 77 |
| Washburn Shops. | 83 |
| Waterbury Farrel Foundry & Mach. Co. | 98 |
| Watson-Stillman Co. | 78 |
| Weidlog Mfg. Co. | 83 |
| Wells Bros. Co. | 68 |
| Westcott Chuck Co. | 82 |
| West End Mfg. Co. | 90 |
| West Haven Mfg. Co. | 4th Cover |
| Westmacott Co., J. M. | 67 |
| Whitcomb Mfg. Co. | 59 |
| Whitman & Barnes Mfg. Co. | 67 |
| Whitney Mfg. Co. | 53 |
| Whiton Mach. Co., D. E. | 82 |
| Wickes Bros. | 74 |
| Williams & Co., J. H. | 98 |
| Winkley Co., The. | 67 |
| Woodward & Powell Planer Co. | 73 |
| Woolley Fdry. & Mach. Works. | 70 |
| Worcester Mach. Screw Co. | 69 |
| Worcester Polytechnic Institute. | 78 |
| Wormer Machinery Co., C. C. | 101 |
| Wyman & Gordon. | 4th Cover |
| Yale & Towne Mfg. Co. | 91 |


# Classified Index of Articles Advertised.


**Abrasive Materials**

Carborundum Co., Niagara Falls, N. Y.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Vitrified Wheel Co., Westfield, Mass.

**Arbor Presses**

Barnes Co., W. F. & John, Rockford, Ill.
Bartlett, E. E., Boston, Mass.
Niles-Bement-Pond Co., New York.
Wilmarth & Morman Co., Grand Rapids, Mich.

**Ball Bearings**

*See Roller Bearings.*

**Balls, Steel**

Federal Mfg. Co., Cleveland, O.

**Band Saws, Metal**

Niles-Bement-Pond Co., New York.
Thompson, Son & Co., Henry G., New Haven, Conn.

**Barrels, Tumbling**

Globe Machine & Stamping Co., Cleveland, O.

**Bars, Boring**

Beaman & Smith Co., Provi., R. I.
Cleveland Twist Drill Co., Cleveland, O.
Elmes Eng. Wks., Chas. F., Chicago, Ill.
Niles-Bement-Pond Co., New York.
Underwood & Co., H. B., Philadelphia, Pa.

**Belt Dressing**

Dixon Crucible Co., Jos., Jersey City, N. J.
Harris Oil Co., A. W., Prov., R. I.

**Belt Filler**

Schieren & Co., Chas. A., New York.

**Belt Lacing Machine**

Diamond Drill & Mach. Co., Birdsboro, Pa.

**Belting, Leather**

Schieren & Co., Chas. A., New York.
Shultz Belting Co., St. Louis, Mo.
Whitman & Barnes Mfg. Co., Chicago, Ill.

**Bending Machinery, Plate**

Hilles & Jones Co., Wilmington, Del.
Niles-Bement-Pond Co., New York.
Perkins Mach. Co., Warren, Mass.
Wickes Bros., New York.

**Bending Machines, Hydraulic**

Niles-Bement-Pond Co., New York.
Watson-Stillman Co., New York.

**Bending Machines, Power**

Ajax Mfg. Co., Cleveland, O.
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Niles-Bement-Pond Co., New York.

**Bending Tools, Hand**

Wallace Supply Co., Chicago, Ill.

**Blocks and Tackles**

*See Hoists, Hand.*

**Blowers**

Am. Gas Furnace Co., N. Y. City.
Buffalo Forge Co., Buffalo, N. Y.
Hartford Blower Co., Hartford, Conn.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.

**Blue Print Machines**

Keuffel & Esser Co., New York.
Pittsburg Blue Print Co., Pittsburg, Pa.

**Blue Print Wringers**

Keuffel & Esser Co., New York.
Pittsburg Blue Print Co., Pittsburg, Pa.

**Boilers**

Struthers-Wells Co., Warren, Pa.
Wickes Bros., New York.

**Bolt and Nut Machinery**

Acme Mchry. Co., Cleveland, O.
Ajax Mfg. Co., Cleveland, O.
Detrick & Harvey Mach. Co., Baltimore, Md.
Howard Iron Wks., Buffalo, N. Y.
Lang Co., G. R., Cincinnati, O.
Niles-Bement-Pond Co., New York.
Reliance Mach. & Tool Co., Cleveland, O.
Standard Engineering Works, Ellwood City, Pa.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.
Webster & Perks Tool Co., Springfield, Ohio.
Wiley & Russell Mfg. Co., Greenfield, Mass.

**Books, Mechanical**

Audel & Co., Theo., New York.
Baird & Co., Henry Carey, Philadelphia, Pa.
Derry-Collard Co., New York.
Henley Pub. Co., The Norman W., New York.

**Boring and Drilling Machines, Horizontal**

Barnes Co. B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Provi., R. I.
Betts Mach. Co., Wilmington, Del.
Binsse Mach. Co., Newark, N. J.
Boynton & Plummer, Worcester, Mass.
Dallett Co., Thos. H., Phila., Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Fosdick Mach. Tool Co., Cin., O.

**Boring and Drilling Machines, Horizontal—*Cont'd***

Hill, Clarke & Co., Boston, Mass.
Lucas Mach. Tool Co., Cleve., O.
McCabe, J. J., New York.
Meadville Vise Co., Meadville, Pa.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Pawling & Harnischfeger, Milwaukee, Wis.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

**Boring and Turning Mills**

American Tool Wks. Co., Cin., O.
Baush Mach. Tool Co., Springfield, Mass.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Betts Mach. Co., Wilmington, Del.
Bickford & Co., H., Lakeport, N. H.
Bullard Mach. Tool Co., Bridgeport, Conn.
Colburn Mch. Tool Co., Franklin, Pa.
Gisholt Mach. Co., Madison, Wis.
Hill, Clarke & Co., Boston, Mass.
King Mach. Tool Co., Cincin., O.
Niles-Bement-Pond Co., New York.
Poole Co., J. Morton, Wilmington, Del.
Prentiss Tool & Supply Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

**Brazing**

Standard Brazing Co., Boston, Mass.

**Bulldozers**

Ajax Mfg. Co., Cleveland, O.

**Cabinets, Oil**

Bowser Co., S. F., Fort Wayne, Ind.

**Carborundum**

*See Grinding Wheels.*

**Castings, Brass and Bronze**

Nolte Brass Co., Springfield, O.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

**Castings, Die Molded**

Franklin Mfg. Co., Syracuse, N. Y.

**Castings, Iron**

Farrel Fdry. & Mach. Co., Ansonia, Conn.
Taunton Loco. Mfg. Co., Taunton, Mass.

**Castings, Steel**

Cooper-Wigand-Cooke Co., New York.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
West End Mfg. Co., New York.

**Centering Machines**

Kempsmith Mfg. Co., Milwaukee, Wis.
Phoenix Mfg. Co., Hartford, Conn.
Pratt & Whitney Co., Hartford, Conn.
Whiton Machine Co., D. E., New London, Conn.

**Centers, Planer**

New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

**Chains, Driving**

Boston Gear Works, Boston, Mass.
Bridgeport Chain Co., Bridgeport, Conn.
Federal Mfg. Co., Cleveland, O.
Jeffrey Mfg. Co., The, Columbus, Ohio.
Link Belt Engr. Co., Phila., Pa.
Morse Chain Co., Trumansburg, N. Y.
Whitney Mfg. Co., Hartford, Ct.

**Chucking Machines**

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland, Ohio.

**Chucks, Drill**

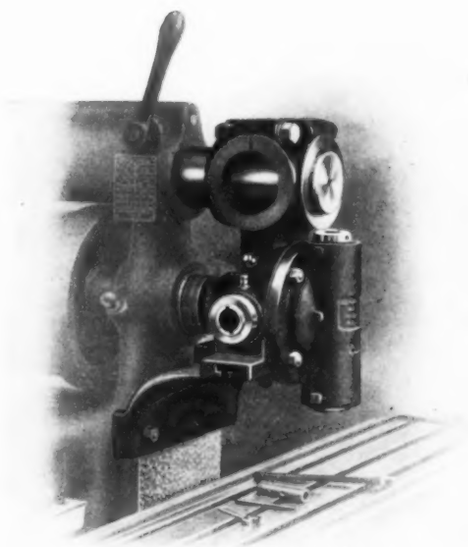
Almond, T. R., Brooklyn, N. Y.
Brown & Co., R. H., New Haven, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Cushman Chuck Co., Hartford, Ct.
Detroit Twist Drill Co., Detroit, Mich.
Goodell-Pratt Co., Greenfield, Mass.
Horton & Son Co., The E., Windsor Locks, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Niles-Bement-Pond Co., New York.
Pratt Chuck Co., Frankfort, N. Y.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Whitney Mfg. Co., Hartford, Ct.
Whiton Mach. Co., D. E., New London, Conn.

**Chucks, Lathe**

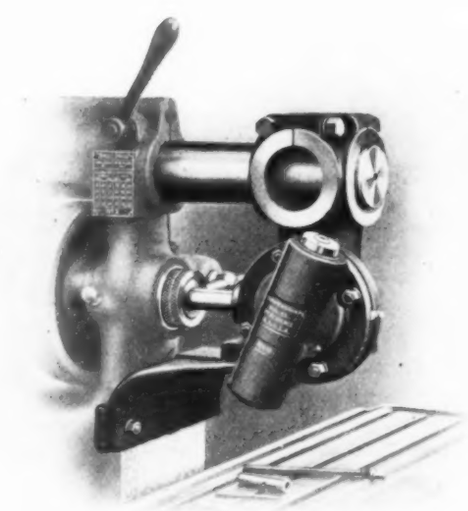
Cushman Chuck Co., Hartford, Ct.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., The E., Windsor Locks, Conn.
Niles-Bement-Pond Co., New York.
Skinner Chuck Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

# BROWN & SHARPE MFG. CO.

**PROVIDENCE, R. I., U.S.A.**



No. 20 Compound Vertical Spindle Milling Attachment in position to allow setting of spindle to angle in plane parallel to table.



No. 20 Compound Vertical Spindle Milling Attachment in position to allow setting of spindle in plane at right angles to table.

## Attachments for Milling Machines

Properly constructed Attachments complete the equipment of a Milling Machine.

### The No. 20 Compound Vertical Spindle Milling Attachment

is new in design, and applicable to a large variety of drilling, spiral milling, milling angular slots in surfaces of any angle, T slots, keyways, and work of a similar character.

**The Spindle** is driven through bevel gears by a horizontal shaft inserted in the main spindle of the machine, and can be set to any angle from a vertical to a horizontal position.

We carry in stock a line of Attachments as follows:

**High Speed Milling Attachments,**
**Vertical Spindle Milling Attachments,**
**Universal Milling Attachment,**
**Slotting Attachments,**
**Circular Milling Attachments,**
**Rack Cutting Attachments,**
**Cam Cutting Attachments,**
**Taper Milling Attachment,**
**Hand Milling Attachment,**
**Gear Cutting Attachment.**

Catalogues and circulars, describing the attachments, mailed to any address.

**Chucks, Magnetic**
Walker & Co., O. S., Worcester, Mass.

**Chucks, Planer**
Niles-Bement-Pond Co., New York.

**Chucks, Split**
Faneuil Watch Tool Co., Boston, Mass.

**Clutches, Friction**
Caldwell, Son & Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Faneuil Watch Tool Co., Boston, Mass.
Johnson Mach. Co., Carlyle, Hartford, Conn.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.

**Clutches, Magnetic and Electrical**
Electric Controller & Supply Co., Cleveland, O.

**Compound, Boiler**
Harris Oil Co., A. W., Provi., R. I.

**Compound, Pipe Joint**
Dixon Crucible Co., Jos. Jersey City, N. J.

**Compressors, Air**
Blaisdell Machinery Co., Bradford, Pa.
Blanchard Mach. Co., Boston, Mass.
Christensen, N. A., Milwaukee, Wis.
Clayton Air Compressor Works, New York.
Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneumatic Tool Co., Montour Falls, N. Y.
Herron & Bury Mfg. Co., Erie, Pa.
Ingersoll-Sergeant Drill Co., New York.
Rand Drill Co., New York.

**Connecting Rods and Straps**
Standard Connecting Rod Co., Beaver Falls, Pa.

**Contract Work**
Blanchard Mach. Co., Boston, Mass.
Taunton Loco. Mfg. Co., Taunton, Mass.

**Controllers and Starters, Electric Motor**
Electric Controller & Supply Co., Cleveland, O.
General Electric Co., New York.

**Coping Machines**
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.

**Correspondence Schools**
*See Schools, Correspondence.*

**Counterbores**
Slocomb Co., J .T., Provi., R. I.

**Countershafts**
Builders' Iron Fdry., Provi., R. I.
National Machine Tool Co., Cincinnati, O.
Power & Speed Controller Co., Boston, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

**Counting and Printing Wheels**
Franklin Mfg. Co., Syracuse, N. Y.

**Couplings, Shaft**
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Stuart, R. J., New Hamburg, N. Y.

**Cranes**
Brown Hoisting Mach. Co., New York.
Case Mfg. Co., Columbus, O.
Chambersburg Engineering Co., Chambersburg, Pa.
Cleveland Crane & Car Co., Wickliffe, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.

**Cranes** —*Continued*
General Pneumatic Tool Co., Montour Falls, N. Y.
Lane Mfg. Co., Montpelier, Vt.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Phila., Pa.

**Crank Pin Turning Machine**
Niles-Bement-Pond Co., New York.
Underwood & Co., H. B., Philadelphia, Pa.

**Crank Shafts**
Standard Connecting Rod Co., Beaver Falls, Pa.

**Crucibles**
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

**Cupolas, and Ladles, Foundry**
Northern Engr. Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Phila., Pa.

**Cut Meters**
Warner Instrument Co., Beloit, Wis.

**Cutters, Milling**
Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Inc., Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Whitney Mfg. Co., Hartford, Ct.

**Cutting-off Machines**
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Davis Mach. Co., W. P., Rochester, N. Y.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mach. Tool Wks., Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.

**Cutting-off Tools**
Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Fairbanks Machine Tool Co., Springfield, O.
Goodell Mfg. Co., Greenfield, Mass.
O. K. Tool Holder Co., Shelton, Conn.
Pratt & Whitney Co., Hartford, Conn.

**Diamond Tools**
Dickinson, Thos. L., New York.
Steel Set Diamond Co., New York.

**Dies, Sheet Metal**
Bliss Co., E. W., Brooklyn, N. Y.
Crucible Steel Forge Co., Cleveland, O.
Globe Machine & Stamping Co., Cleveland, O.
Perkins Mach. Co., Warren, Mass.

**Dies, Threading, Opening**
Errington, F. A., New York.
Geometric Drill Co., New Haven, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.

**Dowel Pins**
Beskin Mfg. Co., Canton, O.
Obermayer Co., S., Cincinnati, O.
Winkley Co., Hartford, Conn.

**Drafting Machines**
Universal Drafting Mach. Co., Cleveland, O.

**Drawing Boards and Tables**
Keuffel & Esser Co., New York.
Rich, J. & G., Philadelphia, Pa.

**Drawing Instruments**
Alteneder & Sons, Theo., Philadelphia, Pa.
Keuffel & Esser Co., New York.

**Drilling Machines, Bench**
Barnes Co., W. F. & John, Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.

**Drilling Machines, Boiler**
American Tool Wks. Co., Cin., O.
Bickford Drill & Tool Co., Cincinnati, O.
Boynton & Plummer, Worcester, Mass.
Dallett Co., Thos. H., Phila., Pa.
Niles-Bement-Pond Co., New York.

**Drilling Machines, Multiple Spindle**
American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Dallett Co., Thos. H., Phila., Pa.
Flather Planer Co., Mark, Nashua, N. H.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
National Auto. Tool Co., Dayton, Ohio.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.

**Drilling Machines, Pneumatic**
Cleveland Pneu. Tool Co., Cleveland, O.
Ingersoll-Sergeant Drill Co., New York.
Niles-Bement-Pond Co., New York.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Rand Drill Co., New York.

**Drilling Machines, Portable**
Coates Clipper Mfg. Co., Worcester, Mass.
Dallett Co., Thos. H., Phila., Pa.
Hisey-Wolf Mch. Co., Cincin., O.
Niles-Bement-Pond Co., New York.

**Drilling Machines, Radial**
American Tool Wks. Co., Cin., O.
Baush Mch. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Dreses Mach. Tool Co., Cincin., O.
Fosdick Mach. Tool Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Mueller Mach. Tool Co., Cin., O.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Vandyck Co., J. R., New York.

**Drilling Machines, Turret**
Niles-Bement-Pond Co., New York.
Vanderbeek Tool Works, Hartford, Conn.

**Drilling Machines, Upright**
American Tool Works Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Blaisdell & Co., P., Worcester, Mass.
Boynton & Plummer, Worcester, Mass.
Burke Machinery Co., Cleveland, Ohio.
Cincinnati Mach. Tool Co., Cin., O.
Dallett Co., Thos. H., Phila., Pa.

**Drilling Machines, Upright** *Continued*
Davis Mach. Co., W. P., Rochester, N. Y.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Sibley Machine Tool Co., South Bend, Ind.
Sloan & Chace Mfg. Co., Newark, N. J.
Vandyck Co., J. R., New York.
Washburn Shops, Worcester, Mass.
Whitney Mfg. Co., Hartford, Conn.

**Drills, Center**
Pratt & Whitney Co., Hartford, Conn.
Slocomb Co., J. T., Providence, R. I.

**Drills, Hand**
Dallett Co., Thos. H., Phila., Pa.
Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.

**Drills, Rail**
Niles-Bement-Pond Co., New York.

**Drills, Ratchet**
Greene, Tweed & Co., New York.
Parker Co., Chas., Meriden, Conn.
Pratt & Whitney Co., Hartford, Conn.

**Dynamos**
C & C Electric Co., New York.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Holtzer-Cabot Elec. Co., Brookline, Mass.
Jantz & Leist Elec. Co., Cin., O.
Keystone Electric Co., Erie, Pa.
Northern Elec. Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Elec. Co., New York.
Triumph Elec. Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

**Electrical Supplies**
Commercial Electric Co., Indianapolis, Ind.
General Elec. Co., New York.
Keystone Electric Co., Erie, Pa.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

**Electrically Driven Tools**
Hisey-Wolf Mach. Co., Cincin., O.

**Elevators**
Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Howard Iron Wks., Buffalo, N. Y.
Morse, Williams & Co., Phila., Pa.

**Emery Wheel Dresser**
Desmond-Stephan Mfg. Co., Urbana, O.
Standard Tool Co., Cleveland, O.

**Emery Wheels**
*See Grinding Wheels.*

**Enclosures, Tool-room**
Merritt & Co., Philadelphia, Pa.

**Engineers, Consulting and Mechanical**
McGeorge & Sons, Cleveland, O.

**Engines, Automobile**
Olds Gasoline Engine Works, Lansing, Mich.

**Engines, Gas and Gasoline**
Backus Water Motor Co., Newark, N. J.
Foos Gas Eng. Co., Springfield, O.
Jacobson Mach. & Mfg. Co., Warren, Pa.
Mietz, August, New York.

# Our Celebrated Bench Miller.

This Machine is particularly adapted to manufacturing sewing machines, typewriters and electrical supply parts. Its output is great. It occupies no floor space and but little bench space, while the price is only $110. We will be glad to send you a folder describing the tool in detail.

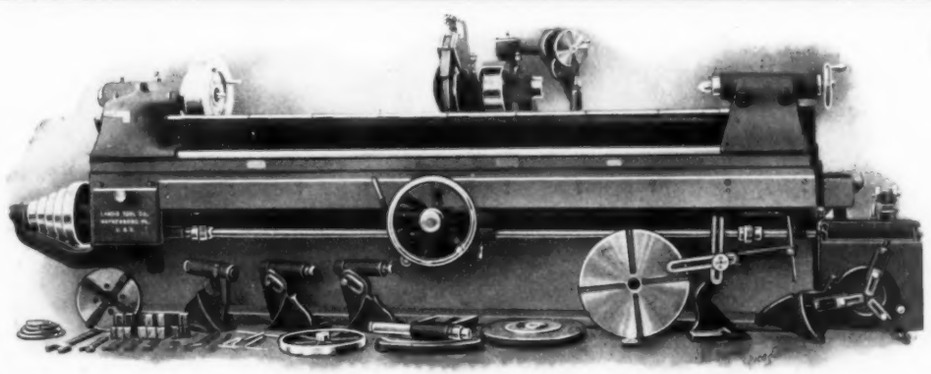
## Hill, Clarke & Company,

Machinery Merchants,

14 So. Canal Street, Chicago.

156 Oliver Street, Boston.

153 Greenwich, cor. 123 Liberty St., New York.



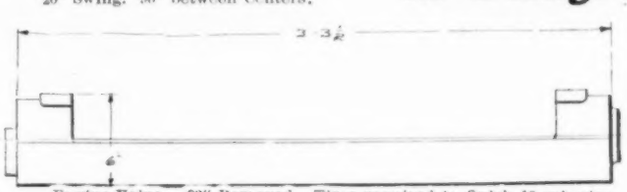
20" Swing. 96" between Centers.

## The Landis No. 8 Universal Grinding Machine And Some Of Its Doings

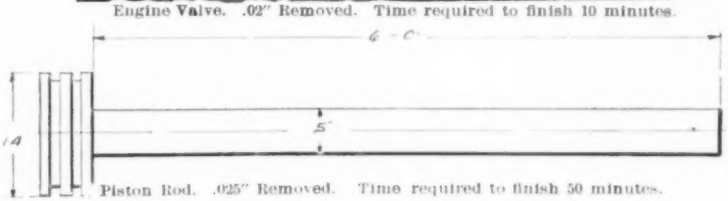
This machine is particularly adapted for Grinding Spindles, Shafts, Cones, and Flat Surfaces that can be held in a chuck or face plate and finished by rotary motion. Especially good for manufacturing purposes, and a valuable tool for finishing large tools and performing a variety of operations not possible with plain machines.

Ample weight in all parts to resist vibration. Spindles carefully finished by grinding. Bearing adjustable for wear and protected against grit and water. Flat surfaces scraped to surface plates. Built throughout to stand severe service. Ample provision for water.

Ask us for further information. You'll profit by the proof.




Engine Valve. .02" Removed. Time required to finish 10 minutes.




Piston Rod. .025" Removed. Time required to finish 50 minutes.

## Landis Tool Company, - Waynesboro, Pa., U.S.A.

AGENTS—Walter H. Foster Co., New York, Boston, Cleveland and Pittsburg. C. W. Burton, Griffiths & Co., London. Schuchardt & Schutte, Berlin, Cologne, Vienna, Brussels, Stockholm, St. Petersburg, Liege, Milano, Bilbao and Paris. A. R. Williams Machinery Co., Toronto. Williams & Wilson, Montreal, Canada.

**Engines, Gas and Gasoline** *Continued*
New Era Gas Engine Co., Dayton, Ohio.
Olds Gasoline Engine Wks., Lansing, Mich.
Regal Gasoline Engine Co., Coldwater, Mich.
Struthers-Wells Co., Warren, Pa.
Woolley Fdry. & Mach. Co., Anderson, Ind.

**Engines, Oil**
Mietz, August, New York.

**Engines, Steam**
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Rand Drill Co., New York.
Struthers-Wells Co., Warren, Pa.
Sturtevant Co., B. F., Hyde Park, Mass.

**Engraving Machinery**
Gorton Mach. Co., Geo., Racine, Wis.

**Exhaust Heads**
Burt Mfg. Co., Akron, O.

**Exhibition, Machinery**
Philadelphia Bourse, Phila., Pa.

**Fans, Electric**
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

**Fans, Exhaust**
Sturtevant Co., B. F., Hyde Park, Mass.

**Files and Rasps**
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Provi., R. I.

**Filing Machines**
Kinsey-Burt Co., New York.

**Fillers, Oil Can**
Winkley Co., The, Hartford, Conn.

**Fillets, Leather and Wood**
Beskin Mfg. Co., Canton, O.
Canton Fillet Co., Canton, O.

**Filters, Oil**
Burt Mfg. Co., Akron, O.

**Flexible Shafts**
Chicago Flexible Shaft Co., Chicago, Ill.
Coates Clipper Mfg. Co., Worcester, Mass.

**Forges**
Boynton & Plummer, Worcester, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Ingersoll-Sergeant Drill Co., New York.
Miner & Peck Mfg. Co., New Haven, Conn.
Sturtevant Co., B. F., Hyde Park, Mass.

**Forgings, Drop**
Billings & Spencer Co., Hartford, Conn.
Lang Co., G. R., Cincinnati, O.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

**Forgings, Hydraulic**
Wyman & Gordon, Worcester, Mass.

**Forgings, Steel**
Crucible Steel Forge Co., Cleveland, O.
Heppenstall Forge & Knife Co., Pittsburg, Pa.
Wyman & Gordon, Worcester, Mass.

**Foundry Furnishings**
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Phila., Pa.

**Furnaces, Coal and Oil**
Obermayer Co., S., Cincinnati, O.
Rockwell Engineering Co., Jersey City, N. J.

**Furnaces, Gas**
Am. Gas Furnace Co., N. Y. City.
Chicago Flexible Shaft Co., Chicago, Ill.
Rockwell Engineering Co., Jersey City, N. J.
Westmacott Co., J. M., Providence, R. I.

**Furniture, Machine Shop**
New Britain Mach. Co., New Britain, Conn.

**Gages, Recording**
Bristol Co., Waterbury, Conn.

**Gages, Standard**
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

**Gages, Steam**
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

**Galvanizing Machinery**
Erie Foundry Co., Erie, Pa.

**Gear Cutting Machinery**
Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Clough, R. M., Tolland, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Newton Mch. Tool Wks., Phil., Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Whiton Machine Co., D. E., New London, Conn.

**Gears, Cut**
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Works, Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Caldwell & Son Co., H. W., Chicago, Ill.
Cleveland Gear Works, Cleve., O.
Cresson Co., Geo. V., Phila., Pa.
Earle Gear & Mach. Co., Philadelphia, Pa.
Fawcus Mch. Co., Pittsburg, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Foster-Kimball Mach. Co., Chicago, Ill.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott Co., The, Cleveland, O.
Meisel Press & Mfg. Co., Boston, Mass.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburg, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Sawyer Gear Wks., Cleveland, O.
Simonds Mfg. Co., Pittsburg, Pa.

**Gears, Molded**
Caldwell & Son Co., H. W., Chicago, Ill.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.

**Gears, Rawhide**
Chicago Raw Hide Mfg. Co., Chicago, Ill.
Earle Gear & Mch. Co., Phila., Pa.
Fawcus Machine Co., Pittsburg, Pa.
Gould & Eberhardt, Newark, N. J.
Horsburgh & Scott Co., Cleveland, Ohio.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburg, Pa.

**Gears, Worm**
Albro-Clem Elevator Co., Philadelphia, Pa.
Fawcus Mch. Co., Pittsburg, Pa.
Gould & Eberhardt, Newark, N. J.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburg, Pa.
Simonds Mfg. Co., Pittsburg, Pa.

**Graphite**
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

**Grinders, Center**
Coates Clipper Mfg. Co., Worcester, Mass.
Heald Mch. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Mueller Mch. Tool Co., Cin., O.
Niles-Bement-Pond Co., New York.

**Grinders, Cutter**
Automatic Mach. Co., Greenfield, Mass.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Greenfield Mach. Co., Greenfield, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

**Grinders, Disk**
Besly & Co., Chas. H., Chicago, Ill.
Diamond Mach. Co., Provi., R. I.
Iroquois Mach. Co., New York.
Ney, R. W., Pine Plains, N. Y.
Ransom Mfg. Co., Oshkosh, Wis.

**Grinders, Drill**
Heald Mch. Co., Worcester, Mass.
Niles-Bement-Pond Co., New York.
Washburn Shops, Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

**Grinders, Portable**
Hisey-Wolf Mach. Co., Cincin., O.

**Grinders, Tool**
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Diamond Mach. Co., Provi., R. I.
Gisholt Mach. Co., Madison, Wis.
Gould & Eberhardt, Newark, N. J.
Hisey-Wolf Mach. Co., Cincin., O.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
Northampton Emery Wheel Co., Leeds, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Webster & Perks Tool Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

**Grinding and Polishing Machines**
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Coates Clipper Mfg. Co., Worcester, Mass.
Diamond Mach. Co., Prov., R. I.
Goodell-Pratt Co., Greenfield, Mass.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., New York.
Landis Tool Co., Waynesboro, Pa.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Ney, R. W., Pine Plains, N. Y.
Niles-Bement-Pond Co., New York.
Northampton Emery Wheel Co., Leeds, Mass.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Norton Grinding Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Royersford Foundry & Mach. Co., Royersford, Pa.
Safety Emery Wheel Co., Springfield, O.
Standard Tool Co., Cleveland, O.
Vandyck Co., J. R., New York.
Vitrified Wheel Co., Westfield, Mass.
Walker Co., O. S., Worcester, Mass.
Washburn Shops, Worcester, Mass.
Webster & Perks Tool Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids, Mich.

**Grinding Wheels**
Adams Co., Dubuque, Iowa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Prov., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Niles-Bement-Pond Co., New York.
Northampton Emery Wheel Co., Leeds, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.
Whitney Mfg. Co., Hartford, Ct.

**Grindstones and Frames**
Cleveland Stone Co., Cleveland, O.
Niles-Bement-Pond Co., New York.

**Gun Barrel Machinery**
Diamond Mach. Co., Prov., R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

**Hack Saw Blades and Frames**
Atkins Co., E. C., Indianapolis, Ind.
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Starrett Co., L. S., Athol, Mass.
Thompson, Son & Co., Henry G., New Haven, Conn.
West Haven Mfg. Co., New Haven, Conn.

**Hack Saws, Power**
Atkins Co., E. C., Indianapolis, Ind.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Hoefer Mfg. Co., Freeport, Ill.
Niles-Bement-Pond Co., New York.
Thompson, Son & Co., Henry G., New Haven, Conn.
West Haven Mfg. Co., New Haven, Conn.

**Hammers, Drop**
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Chambersburg Engineering Co., Chambersburg, Pa.
Gould & Eberhardt, Newark, N. J.
Miner & Peck Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Perkins Mach. Co., Warren, Mass.

**Hammers, Pneumatic**
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett Co., Thos. H., Phila., Pa.
Ingersoll-Sergeant Drill Co., New York.
Niles-Bement-Pond Co., New York.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Rand Drill Co., New York.

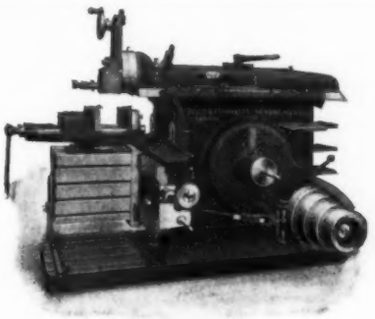
**Hammers, Power**
Niles-Bement-Pond Co., New York.
Scranton & Co., The, New Haven, Conn.

**Hammers, Steam**
Bethlehem Fdry & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

**Hangers, Shafting**
Cresson Co., Geo. V., Phila., Pa.
Standard Pressed Steel Co., Philadelphia, Pa.

**Heating and Ventilating Apparatus**
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Mass.

**Heating Machines, Automatic**
Am. Gas Furnace Co., New York.
Rockwell Engineering Co., Jersey City, N. J.



OUR New Shaper Catalog is now in the hands of the printer, and will be ready for distribution within a week or so. It is a comprehensive book, telling briefly the points of merit of the G. & E. Shapers, with illustrations that will interest both the man who buys and the man who uses shapers.

If you are interested in the shaper question at the present time, or if you expect to be, send us your address on a postal card and we'll be glad to add you to our mailing list; or, write to our nearest agent.

# Gould & Eberhardt,

## Newark, N. J., U.S.A.

**Designers and Builders of High Class Machine Tools.**

SELLING AGENTS—Manning, Maxwell & Moore, New York and Boston. Baird Machinery Co., Pittsburgh, Pa. Marshall & Huschart Machinery Co., Chicago and Cleveland. The Fairbanks Co., Philadelphia and Baltimore. Henshaw, Bulkley & Co., San Francisco and Seattle. W. R. Colcord Machinery Co., St. Louis. Prentiss Tool & Supply Co., Buffalo. P. H. McArdle, New Orleans.

FOREIGN AGENTS—Schuchardt & Schutte, Berlin, Cologne, Vienna, Brussels, Stockholm, St. Petersburg, Milan. Selig, Sonnenthal & Co., London, England. John Lang & Sons, Johnstone, Scotland. Paul Roux & Co., Paris, France. White, Child & Beney, Shaper and Drill Press Agents, Vienna.

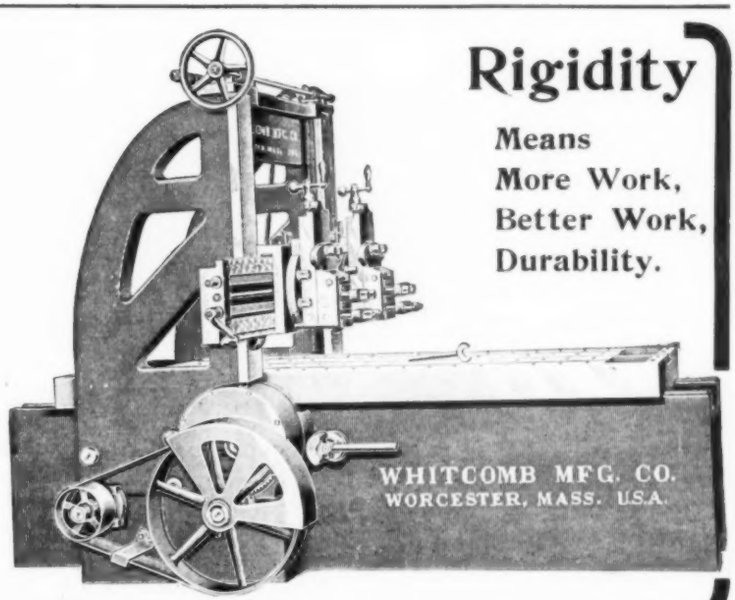
# Whitcomb Planers

are rigid as well as strong. Their rigidity enables them to turn out truer work than planers that tremble. They do their work easier and better and run so smoothly that there's very little wear and tear. The Second-belt Drive Planers run noiselessly too. There's very little opportunity for back-lash to appear in the gearing. Get the catalog.

## Whitcomb Mfg. Co.,

**Worcester, Mass., U.S.A.**

SELLING AGENTS: Hill, Clarke & Co., Boston. Thomas & Lowe Machinery Co., Providence. The J. R. Vandyck Co. New York and Philadelphia. Syracuse Supply Co., Ltd., Syracuse. Chas. G. Smith Co., Pittsburg. W. M. Pattison Machinery Co., Cleveland. McDowell, Stocker & Co., Chicago. Zimmerman-Wells-Brown Co., Portland, Oregon. Tatem & Bowen, San Francisco.




## Rigidity

**Means More Work, Better Work, Durability.**

**Hoisting and Conveying Machinery**
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Hunt Co., C. W., West New Brighton, N. Y.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

**Hoists, Electric**
C & C Electric Co., New York.
Cleveland Crane & Car Co., Wickliffe, Ohio.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Sprague Electric Co., New York.

**Hoists, Hand**
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Yale & Towne Mfg. Co., New York.

**Hoists, Pneumatic**
Cleveland Pneumatic Tool Co., Cleveland, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneumatic Tool Co., Montour Falls, New York.
Rand Drill Co., New York.

**Igniters, Gas Engine**
Remy Electric Co., Anderson, Ind.

**Indicators, Speed**
Starrett Co., L. S., Athol, Mass.
Weidlog Mfg. Co., Brooklyn, N. Y.

**Indicators, Speed, Peripheral**
Warner Instrument Co., Beloit, Wis.

**Indicators, Steam**
Crosby Steam Gage & Valve Co., Boston, Mass.

**Injectors**
Desmond-Stephan Mfg. Co., Urbana, O.
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

**Inspection and Tests**
Hunt Co., Robt. W., Chicago, Ill.

**Instruction Schools**
*See Schools, Correspondence.*

**Insurance, Boiler**
Hartford Steam Boiler Insp. & Ins. Co., Hartford, Conn.

**Jacks, Hydraulic**
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

**Jacks, Planer**
Armstrong Bros. Tool Co., Chicago, Ill.

**Jacks, Screw**
Norton, A. O., Boston, Mass.

**Key Seaters**
Baker Bros., Toledo, O.
Chattanooga Mchry. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Lapointe Mach. Tool Co., Boston, Mass.
Mitts & Merrill, Saginaw, Mich.
Niles-Bement-Pond Co., New York.
Whitney Mfg. Co., Hartford, Ct.

**Keys, Machine**
Standard Gauge Steel Co., Beaver Falls, Pa.
Whitney Mfg. Co., Hartford, Ct.

**Lamps, Arc**
General Electric Co., N. Y. City.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

**Lathe Attachments**
Bradford Machine Tool Co., Cincinnati, O.
National Machine Tool Co., Cincinnati, O.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.

**Lathe Dogs**
Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.

**Lathes**
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Barker & Co., Wm., Cincin., O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Blaisdell & Co., P., Worcester, Mass.
Bradford Mach. Tool Co., Cin., O.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Prov., R. I.
Fairbanks Mach. Tool Co., Springfield, O.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Machine Co., Madison, Wis.
Greaves, Klusman & Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Springfield Mch. Tool Co., Springfield, O.
Vandyck Co., J. R., New York.
Washburn Shops, Worcester, Mass.

**Lathes, Automatic Screw-Threading**
Automatic Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., Hartford, Conn.

**Lathes, Bench**
American Watch Tool Co., Waltham, Mass.
Faneuil Watch Tool Co., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Waltham Watch Tool Co., Springfield, Mass.

**Lathes, Boring**
Niles-Bement-Pond Co., New York.

**Letters, Pattern**
Beskin Mfg. Co., Canton, O.
Butler, A. G., N. Y. City.

**Lockers, Clothes**
Merritt & Co., Philadelphia, Pa.

**Lubricants**
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.
Foote, Pierson & Co., New York.
Harris Oil Co., A. W., Providence, R. I.

**Lubricators**
Besly & Co., Chas. H., Chicago, Ill.
Greene, Tweed & Co., New York.
Lunkenheimer Co., Cincinnati, O.

**Machinery Builders, Special**
Beaman & Smith Co., Provi., R. I.
Bilgram, Hugo, Philadelphia, Pa.
Blanchard Mach. Co., The, Boston, Mass.
Dallett Co., Thos. H., Phila., Pa.
Fawcus Mch. Co., Pittsburg, Pa.
Hoefer Mfg. Co., Freeport, Ill.
Lucas Mch. Tool Co., Cleveland, Ohio.
Pratt & Whitney Co., Hartford, Conn.

**Machinery Builders, Special** *Continued*
Ramsey & Thornley Mfg. Co., Paterson, N. J.
Simonds Mfg. Co., Pittsburg, Pa.
Taunton Loco. Mfg. Co., Taunton, Mass.

**Machinists' Small Tools**
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb Co., J. T., Prov., R. I.
Standard Tool Co., Cleveland, O.
Starrett Co., L. S., Athol, Mass.
Steckenreiter Mfg. Co., New York.

**Machinists' Supplies**
Hammacher, Schlemmer & Co., New York.
Whitman & Barnes Mfg. Co., Chicago, Ill.

**Magnets, Lifting**
Electric Controller & Supply Co., Cleveland, O.

**Mandrels, Expanding**
Nicholson & Co., W. H., Wilkesbarre, Pa.

**Mandrels, Solid**
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

**Measuring Machines**
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Steckenreiter Mfg. Co., New York.

**Metal, Bearing**
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Besly & Co., Chas. H., Chicago, Ill.

**Micrometer Calipers**
Brown & Sharpe Mfg. Co., Providence, R. I.
Mass. Tool Co., Greenfield, Mass.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

**Milling Attachments**
Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Whitney Mfg. Co., Hartford, Conn.

**Milling Machines, Bench**
American Watch Tool Co., Waltham, Mass.
Faneuil Watch Tool Co., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
Niles-Bement-Pond Co., New York.
Sloan & Chace Mfg. Co., Newark, N. J.
Waltham Watch Tool Co., Springfield, Mass.

**Milling Machines, Horizontal**
Beaman & Smith Co., Prov., R. I.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Cincinnati Mill. Mach. Co., Cincinnati, O.
Hendey Mach. Co., Torrington, Ct.
Hess-Bright Mfg. Co., Phila., Pa.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.

**Milling Machines, Plain**
Adams Co., Dubuque, Iowa.
American Tool Wks. Co., Cin., O.
Beaman & Smith Co., Provi., R. I.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles-Bement-Pond Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Vandyck Co., J. R., New York.
Whitney Mfg. Co., Hartford, Ct.

**Milling Machines, Portable**
Underwood & Co., H. B., Philadelphia, Pa.

**Milling Machines, Universal**
American Tool Works Co., Cin., O.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Conn.
Hill, Clarke & Co., Boston, Mass.
Kempsmith Mfg. Co., Milwaukee, Wis.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles-Bement-Pond Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Vandyck Co., J. R., New York.
Waltham Watch Tool Co., Springfield, Mass.

**Milling Machines, Vertical**
Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Provi., R. I.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Clough, R. M., Tolland, Conn.
Garvin Mach. Co., New York.
Ingersoll Mill. Mach. Co., Rockford, Ill.
Newton Mch. Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.

**Milling Tools, Adjustable**
Geometric Drill Co., New Haven, Conn.
Rogers, Boat, Gage & Drill Works, John M., Gloucester City, N. J.

**Molding Machines**
Adams Co., The, Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.
Webster & Perks Tool Co., Springfield, O.

**Mortising Machines, Chain**
New Britain Mch. Co., New Britain, Conn.

**Motors, Electric**
C & C Electric Co., New York.
Coates Clipper Mfg. Co., Worcester, Mass.
Commercial Electric Co., Indianapolis, Ind.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Holtzer-Cabot Elec. Co., Brookline, Mass.
Jantz & Leist Elec. Co., Cin., O.
Keystone Elec. Co., Erie, Pa.
Northern Electrical Mfg. Co., Madison, Wis.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.

# When You Want Cutters

point your order this way—you get them right, and right on time. We have the largest stock of "standards" and many "specials" ready for rush delivery. When you want cutters that other makers can't make, remember that we **can** make them. We make all sorts of cutters—nothing but cutters—and we have the facilities and experience to make better cutters all through and do the work the other fellow doesn't know how to do, and couldn't do it if he did know how.

## Gay & Ward, Incorporated,

### Athol, Mass., - - U. S. A.

New York Office: Carlisle & Van Gelder, 17 Warren Street.
London Agents: Chas. Neat & Co., 112 Queen Victoria St., E.C.

**Our New Catalog will soon be ready. Send in your address.**

**Motors, Electric**—*Continued*
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

**Name Plates**
Franklin Mfg. Co., Syracuse, N. Y.

**Numbering Machines**
Bates Machine Co., New York.

**Nut Tappers**
*See Bolt and Nut Machinery.*

**Oil Cups and Covers**
Bay State Stamping Works, Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Winkley Co., Hartford, Conn.

**Oils**
Besly & Co., Chas. H., Chicago, Ill.
Foote, Pierson & Co., New York.
Harris Oil Co., A. W., Prov., R. I.

**Oils, Slushing**
Harris Oil Co., A. W., Prov., R. I.

**Oils, Tempering**
Harris Oil Co., A. W., Prov., R. I.

**Packing, Steam Joint**
Greene, Tweed & Co., New York.
Jenkins Bros., New York.

**Pans, Lathe**
New Britain Mch. Co., New Britain, Conn.

**Patents**
Hill, Louis A., Washington, D. C.
Stitt, Fred'k S., New York.
Straley, Hasbrouck & Schloeder, New York.

**Pattern Shop Machinery and Supplies**
Baker Bros., Toledo, O.
Beskin Mfg. Co., Canton, O.
Greaves, Klusman & Co., Cin.,O.
Oliver Mchry. Co., Grand Rapids, Mich.
Prentiss Tool & Supply Co., New York.
Washburn Shops, Worcester, Mass.

**Patterns and Models**
Penn Pattern & Model Works, Philadelphia, Pa.

**Pencils**
Keuffel & Esser Co., New York.

**Phosphor Bronze**
Phosphor Bronze Smelting Co., Philadelphia, Pa.

**Pinion Cutters**
American Watch Tool Co., Waltham, Mass.
Gould & Eberhardt, Newark, N. J.
Sloan & Chace Mfg. Co., Newark, N. J.

**Pipe and Fittings**
Crane Co., Chicago, Ill.

**Pipe Cutting and Threading Machines**
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Merrell Mfg. Co., Toledo, O.
Niles-Bement-Pond Co., New York.
Reed Mfg. Co., Erie, Pa.
Saunders' Sons, D., Yonkers, N. Y.
Standard Engineering Works, Ellwood City, Pa.
Stoever Fdry. & Mfg. Co., Myerstown, Pa.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

**Pipe Fitters' Tools**
Cleveland Twist Drill Co., Cleveland, O.
Saunders' Sons, D., Yonkers, N. Y.
Standard Tool Co., Cleveland, O.

**Planers**
Ajax Mfg. Co., Cleveland, O.
American Fdry. & Mach. Co., Hanover, Pa.
American Tool Wks. Co., Cin., O.
Belmer Mach. Tool Co., Cin., O.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Betts Mach. Co., Wilmington, Del.
Bilgram, Hugo, Philadelphia, Pa.

**Planers**—*Continued*
Blaisdell & Co., P., Worcester, Mass.
Cincinnati Planer Co., Cincin., O.
Detrick & Harvey Mch. Co., Baltimore, Md.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Pond Mach. & Fdry. Co., L. W., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Wm., Phila., Pa.
Vandyck Co., J. R., New York.
Whitcomb Mfg. Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.

**Planers, Portable**
Niles-Bement-Pond Co., New York.
Underwood & Co., H. B., Philadelphia, Pa.

**Planers, Rotary**
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Underwood & Co., H. B., Philadelphia, Pa.

**Presses, Drop**
Miner & Peck Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

**Presses, Forging**
Chambersburg Engineering Co., Chambersburg, Pa.

**Presses, Hand**
Elmes Eng. Wks., Chas. F., Chicago, Ill.
Perkins Mach. Co., Warren, Mass.

**Presses, Hydraulic**
Chambersburg Engineering Co., Chambersburg, Pa.
Elmes Eng. Wks., Chas. F., Chicago, Ill.
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., New York.

**Presses, Power**
Automatic Mach. Co., Bridgeport, Conn.
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Chambersburg Engr. Co., Chambersburg, Pa.
Dill Machine Works, T. C., Philadelphia, Pa.
Falkenau-Sinclair Co., Phila., Pa.
Niles-Bement-Pond Co., New York.
Perkins Mach. Co., Warren, Mass.
Prentiss Tool & Supply Co., New York.
Springfield Mch. Tool Co., Springfield, O.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

**Profilers**
Becker-Brainard Mill. Mach. Co., Hyde Park, Mass.
Garvin Mach. Co., New York.
Pratt & Whitney Co., Hartford, Conn.

**Pullers**
Crane & Richardson, Boston, Mass.

**Pulleys**
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Federal Mfg. Co., Cleveland, O.
Howard Iron Wks., Buffalo, N. Y.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Reeves Pulley Co., Columbus, Ind.
Wilmarth & Morman Co., Grand Rapids, Mich.

**Pulleys, Speed Changing**
Evans Friction Cone Co., Newton Center, Mass.
Speed Changing Pulley Co., Indianapolis, Ind.

**Pulley Turning and Boring Machines**
Harrington, Son & Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Pond Mach. & Fdry. Co., L. W., Worcester, Mass.

**Pumps, Hydraulic**
Elmes Eng. Wks., Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

**Punches, Centering**
Goodell Mfg. Co., Greenfield, Mass.

**Punches, Hydraulic**
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., New York.

**Punches, Power**
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Bliss Co., E. W., Brooklyn, N. Y.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Perkins Mach. Co., Warren, Mass.
Royersford Foundry & Mach. Co., Royersford, Pa.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

**Pyrometers**
Engelhard, Chas., New York.

**Rack Cutting Machines**
Adams Co., Dubuque, Iowa.
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

**Racks, Cut**
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Nuttall Co., R. D., Pittsburg, Pa.
Simonds Mfg. Co., Pittsburg, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.

**Racks, Tool**
New Britain Mach. Co., New Britain, Conn.

**Rapping Plates**
Beskin Mfg. Co., Canton, O.

**Reamers**
Cleveland Twist Drill Co., Cleveland, O.
Clough, R. M., Tolland, Conn.
Lapointe Mach. Tool Co., Boston, Mass.
McCrosky Mfg. Co., F. B., Meadville, Pa.
Mergenthaler Co., Ott., Baltimore, Md.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Schellenbach & Radcliffe, Cincinnati, O.
Standard Tool Co., Cleveland, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

**Reaming Stands**
Flather Planer Co., Mark, Nashua, N. H.

**Rheostats**
Electric Controller & Supply Co., Cleveland, O.

**Riveters, Hydraulic**
Chambersburg Engineering Co., Chambersburg, Pa.
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., New York.

**Riveters, Pneumatic**
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett Co., Thos. H., Phila., Pa.
General Pneumatic Tool Co., Montour Falls, N. Y.
Ingersoll-Sergeant Drill Co., New York.
Niles-Bement-Pond Co., New York.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Rand Drill Co., New York.

**Riveters, Steam**
Chambersburg Engineering Co., Chambersburg, Pa.

**Riveting Machines**
Bethlehem Foundry & Mach. Co., So. Bethlehem, Pa.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Perkins Mach. Co., Warren, Mass.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

**Roller and Ball Bearings**
Auburn Ball Bearing Co., Rochester, N. Y.
Ball Bearing Co., Phila., Pa.
Bantam Mfg. Co., Bantam, Conn.
Hess-Bright Mfg. Co., Phila., Pa.
Hyatt Roller Bearing Co., Harrison, N. J.
Standard Roller Bearing Co., Philadelphia, Pa.

**Rolling Mill Machinery**
Diamond Drill & Mach. Co., Birdsboro, Pa.
Dill Machine Works, T. C., Philadelphia, Pa.
Erie Foundry Co., Erie, Pa.
Hilles & Jones Co., Wilmington, Del.
Niles-Bement-Pond Co., New York.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

**Rules, Steel**
Keuffel & Esser Co., New York.
Sawyer Tool Co., Fitchburg, Mass.
Slocomb Co., J. T., Provi., R. I.
Starrett Co., L. S., Athol, Mass.

**Safety Valves, Pop**
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

**Sand Blast Apparatus**
Paxson Co., J. W., Philadel., Pa.

**Sand Mixing and Sifting Machines**
Gould & Eberhardt, Newark, N. J.
Obermayer Co., S., Cincinnati, O.

**Sawing Machines, Metal**
Atkins Co., E. C., Indianapolis, Ind.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Newton Mach. Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Tabor Mfg. Co., Phila., Pa.
Thompson, Son & Co., Henry G., New Haven, Conn.
Vandyck Co., J. R., New York.
West Haven Mfg. Co., New Haven, Conn.

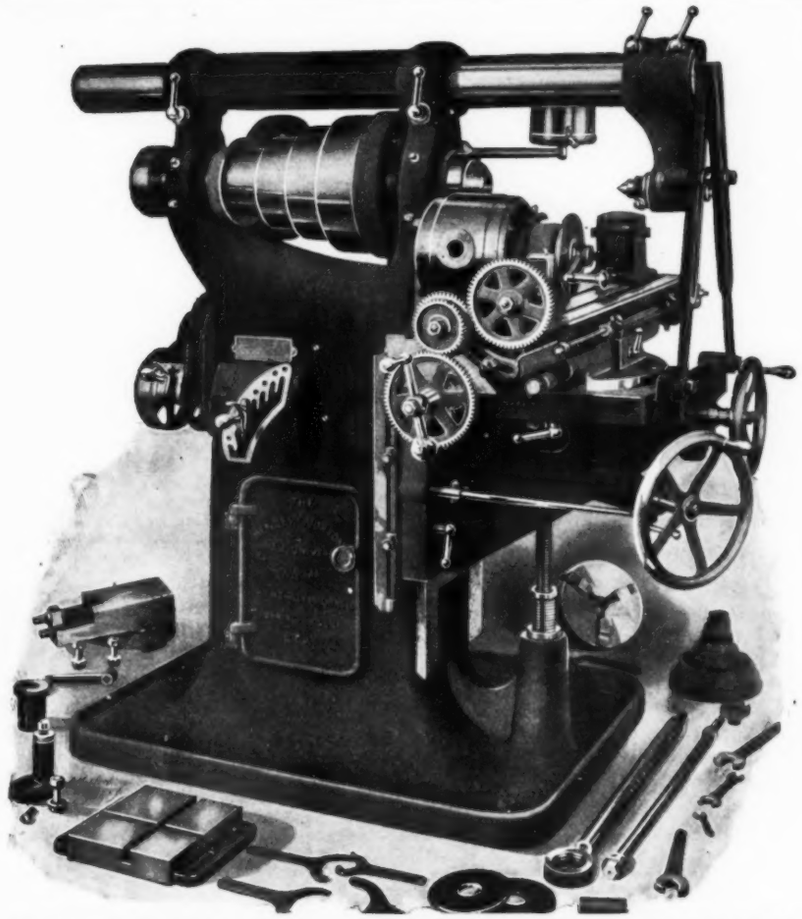
**Sawing Machines, Wood**
Colburn Mach. Tool Co., Franklin, Pa.

**Schools, Correspondence**
Amer. School of Correspondence, Chicago, Ill.

**Schools, Technical**
Mich. College of Mines, Houghton, Mich.
Worcester Poly. Institute, Worcester, Mass.

**Screw Machines, Automatic**
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Foster-Kimball Mach. Co., Chicago, Ill.
Marshall & Huschart Mchry. Co., Chicago, Ill.
National Acme Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Windsor Mach. Co., Windsor, Vt.

**Screw Machines, Hand**
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Garvin Mach. Co., New York.
Jones & Lamson Mch. Co., Springfield, Vt.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.



# HENDEY-NORTON

# MILLERS.

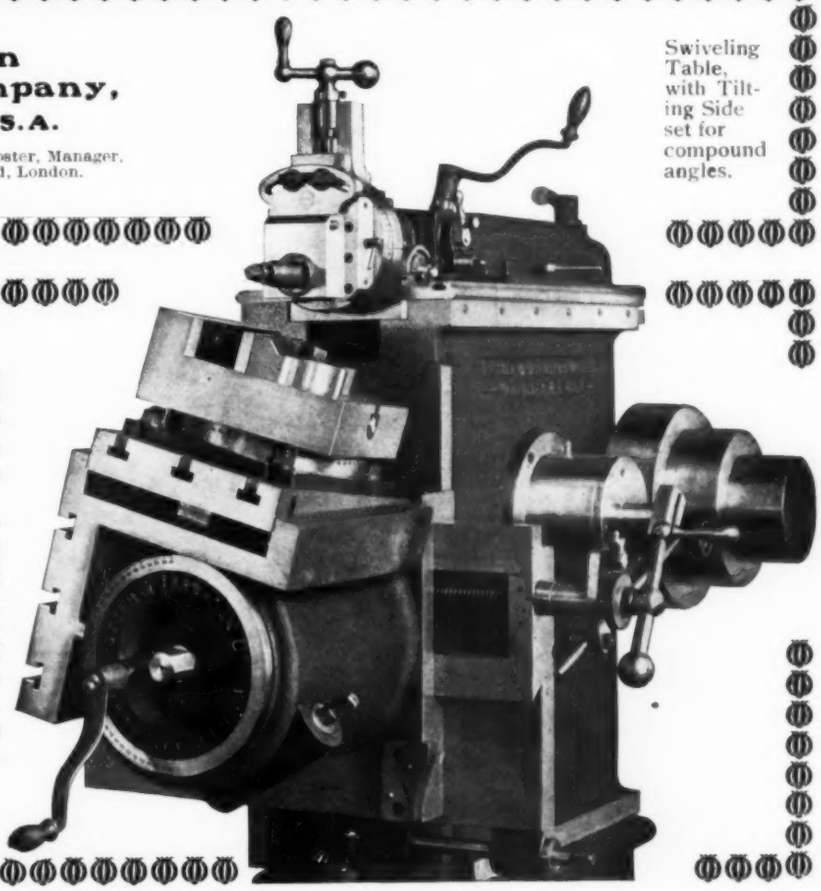
No. 3 Universal Miller. All feeds automatic. Micrometer adjustment for feed trips. Taper-bearing self-oiling spindle. Working Surface of Table, 46½ x 10½. Range of Feeds, 30x8x18½. Capacity of Centers, 12″x27″. May be furnished with roller chain drive.

...THE...
HENDEY MACHINE CO.,
TORRINGTON, CONN., U.S.A.

Manning, Maxwell & Moore, General Agents.
The J. W. Cregar Agency, Philadelphia. } Special Agents.
The W. M. Pattison Mach'y Co., Cleveland. }
Thomas & Lowe Mach'y Co., Providence. }

**Potter & Johnston Machine Company,**
**Pawtucket, R. I., U.S.A.**

New York: 126 Liberty Street, Walter H. Foster, Manager.
Chas. Churchill & Co., Agts. for England, London.



Swiveling Table, with Tilting Side set for compound angles.

**The Swiveling Table, with Tilting Side** is one of the many features of the Potter & Johnston Shaper. This table allows you to complete several operations at one setting of the work, saving a great deal of time and insuring accuracy. P. & J. Shapers are known as profit producers of the first order. If the object of your business is to make a dollar or so against declining years, the P. & J. Shaper puts you in a way to a fast realization of the desire. Book?

**Screw Machinery, Wood and Lag**
Baker Bros., Toledo, O.
Cook Co., Asa S., Hartford, Conn.

**Screw Plates**
Besly & Co., Chas. H., Chicago, Ill.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Card Mfg. Co., S. W., Mansfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

**Screws, Machine**
Cincinnati Screw & Tap Co., Cincinnati, O.
Cleveland Cap Screw Co., Cleveland, O.
National Acme Mfg. Co., Cleveland, O.
Worcester Mach. Screw Co., Worcester, Mass.

**Second Hand Machinery**
Baird Machy. Co., Pittsburg, Pa.
Fairbanks Co., Philadelphia, Pa.
Garvin Mch. Co., New York.
Hill, Clarke & Co., Boston, Mass.
Marshall & Huschart Mchry. Co., Chicago, Ill.
McCabe, J. J., New York.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wickes Bros., New York.
Wormer Machy. Co., C. C., Detroit, Mich.

**Separators, Magnetic**
Cresson Co., Geo. V., Phila., Pa.
Sawyer, Ezra, Worcester, Mass.

**Separators, Oil**
National Separator & Mch. Co., Concord, N. H.

**Separators, Steam**
Nicholson & Co., W. H., Wilkesbarre, Pa.

**Shafting**
Cresson Co., Geo. V., Phila., Pa.
Cumberland Steel Co., Cumberland, Md.
Niles-Bement-Pond Co., New York.

**Shapers**
American Tool Wks. Co., Cin., O.
Barker & Co., Wm., Cincinnati, O.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Boynton & Plummer, Worcester, Mass.
Cincinnati Shaper Co., Cincin., O.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Mach. Co., New York.
Gould & Eberhardt, Newark, N. J.
Hendey Mch. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Kelly Co., R. A., Xenia, Ohio.
Marshall & Huschart Mchry. Co., Chicago, Ill.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Perkins Mach. Co., Warren, Mass.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Smith & Mills, Cincinnati, O.
Springfield Mch. Tool Co., Springfield, O.
Steptoe Shaper Co., John, Cincinnati, O.
Vandyck Co., J. R., New York.

**Shapers, Vertical Die**
Rochester Die Shaper Co., Rochester, N. Y.

**Shear Knives, Solid Steel**
Heppenstall Forge & Knife Co., Pittsburg, Pa.

**Shears, Power**
Bethlehem Fdry. & Mch. Co., So. Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Erie Foundry Co., Erie, Pa.
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Perkins Mach. Co., Warren, Mass.
Royersford Foundry & Mach. Co., Royersford, Pa.

**Shears, Rotary**
Bethlehem Fdry & Mch. Co., So. Bethlehem, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Perkins Mach. Co., Warren, Mass.

**Shelving, Shop**
New Britain Mach. Co., New Britain, Conn.

**Slide Rests**
Reed Co., F. E., Worcester, Mass.

**Slotters**
Baker Bros., Toledo, Ohio.
Betts Mach. Co., Wilmington, Del.
Dill Machine Works, T. C., Philadelphia, Pa.
Garvin Mach. Co., New York.
National Acme Mfg. Co., Cleveland, O.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

**Speed Changing Countershaft**
Cresson Co., Geo. V., Phila., Pa.
National Mach. Tool Co., Cin., O.
Power & Speed Controller Co., Boston, Mass.
Reeves Pulley Co., Columbus, Ind.

**Sprocket Chains**
*See Driving Chains.*

**Stampings, Sheet Steel**
Federal Mfg. Co., Cleveland, O.
Globe Machine & Stamping Co., Cleveland, O.

**Stamps, Steel**
Schwerdtle Stamp Co., Bridgeport, Conn.

**Steam Fittings**
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
Jenkins Bros., New York.
Lunkenheimer Co., Cincinnati, O.

**Steel, Machinery**
Colonial Steel Co., Pittsburg, Pa.
Kent & Co., Edwin R., Chicago, Ill.
Ward & Son, Edgar T., Boston, Mass.

**Steel, Sheet**
Colonial Steel Co., Pittsburg, Pa.
Federal Mfg. Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

**Steel, Tool**
Colonial Steel Co., Pittsburg, Pa.
Firth-Sterling Steel Co., Demmler, Pa.
Kent & Co., Edwin R., Chicago, Ill.
Patterson, Gottfried & Hunter, Ltd., New York.
Ward & Son, Edgar T., Boston, Mass.

**Straightener, Hydraulic**
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., New York.

**Swaging Machines**
Excelsior Needle Co., Torrington, Conn.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

**Switchboards**
C & C Electric Co., New York.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

**Tapping Machines and Attachments**
American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Beaman & Smith Co., The, Providence, R. I.
Bickford Drill & Tool Co., Cin., O.
Burke Mchy. Co., Cleveland, O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Errington, F. A., N. Y. City.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Geometric Drill Co., New Haven, Conn.
Gould & Eberhardt, Newark, N. J.
Modern Tool Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Webster & Perks Tool Co., Springfield, O.
Whitney Mfg. Co., Hartford, Ct.

**Taps and Dies**
Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Geometric Drill Co., New Haven, Conn.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Superior Tap Co., Springfield, Vt.
Webster & Perks Tool Co., Springfield, O.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

**Taps, Collapsing**
Geometric Drill Co., New Haven, Conn.

**Telephones, Interior**
Holtzer-Cabot Elec. Co., Brookline, Mass.

**Thermit**
Goldschmidt Thermit Co., New York.

**Thread Cutting Tools**
Besly & Co., Chas. H., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

**Tool Holders**
Armstrong Bros. Tool Co., Chicago, Ill.
Fairbanks Mach. Tool Co., Springfield, O.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
O. K. Tool Holder Co., Shelton, Conn.
Pratt & Whitney Co., Hartford, Conn.

**Tools, Small**
*See Machinists' Small Tools.*

**Tracing Cloth**
Keuffel & Esser Co., New York.

**Transmission Machinery**
American Pulley Co., Phila., Pa.
Caldwell & Son Co., H. W., Chicago, Ill.
Case Mfg. Co., Columbus, O.
Cresson & Co., Geo. V., Phila., Pa.
Federal Mfg. Co., Cleveland, O.
Hyatt Roller Bearing Co., Harrison, N. J.
Link-Belt Engineering Co., Philadelphia, Pa.
National Machine Tool Co., Cincinnati, O.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Power & Speed Controller Co., Boston, Mass.
Reeves Pulley Co., Columbus, Ind.
Standard Pressed Steel Co., Philadelphia, Pa.

**Trimmers, Wood**
Oliver Mchry. Co., Grand Rapids, Mich.
Washburn Shops, Worcester, Mass.

**Trolleys and Tramways**
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Link-Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Yale & Towne Mfg. Co., New York.

**Turret Machines**
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn.
Dreses Mach. Tool Co., Cincin., O.
Flather & Co., Nashua, N. H.
Foster Co., Walter H., New York.
Garvin Mach. Co., New York.
Gisholt Mch. Co., Madison, Wis.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Louge & Shipley Mach. Tool Co., Cincinnati, O.
Niles-Bement-Pond Co., New York.

**Turret Machines**—*Continued*
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio.

**Twist Drills**
Cleveland Twist Drill Co., Cleveland, O.
Detroit Twist Drill Co., Detroit, Mich.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & M. Co., New Bedford, Mass.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Standard Tool Co., Cleveland, O.
Whitman & Barnes Mfg. Co., Chicago, Ill.

**Universal Joints**
Baush Mach. Tool Co., Springfield, Mass.
Gould & Eberhardt, Newark, N. J.
Vanderbeek Tool Works, Hartford, Conn.

**Unions, Brass**
Lunkenheimer Co., Cincinnati, O.
Nolte Brass Co., Springfield, O.

**Valves**
*See Steam Fittings.*

**Vises, Drill**
Graham Mfg. Co., Provi., R. I.

**Vises, Metal Workers'**
Hammacher, Schlemmer & Co., New York.
Howard Iron Wks., Buffalo, N. Y.
Meadville Vise Co., Meadville, Pa.
Parker Co., Chas., Meriden, Conn.
Reed Mfg. Co., Erie, Pa.
Vanderbeek Tool Works, Hartford, Conn.

**Vises, Pipe**
Curtis & Curtis Co., Bridgeport, Conn.
Meadville Vise Co., Meadville, Pa.
Saunders' Sons, D., Yonkers, N. Y.

**Vises, Planer and Shaper**
Cincinnati Planer Co., Cincin., O.
Hendey Mach. Co., Torrington, Ct.
Meadville Vise Co., Meadville, Pa.
Niles-Bement-Pond Co., New York.

**Vises, Wood Workers'**
Emmert Mfg. Co., Waynesboro, Pa.
Hammacher, Schlemmer & Co., New York.
Meadville Vise Co., Meadville, Pa.
Wyman & Gordon, Worcester, Mass.

**Welding**
Goldschmidt Thermit Co., New York.

**Welding, Electric**
Standard Welding Co., Cleveland, Ohio.

**Welding Machines**
Long & Allstatter Co., Hamilton, Ohio.

**Wire-Drawing Machinery**
Iroquois Mach. Co., New York.

**Wire-Forming Machinery**
Automatic Mach. Co., Bridgeport, Conn.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

**Wire-Straightening Machinery**
Hoefer Mfg. Co., Freeport, Ill.

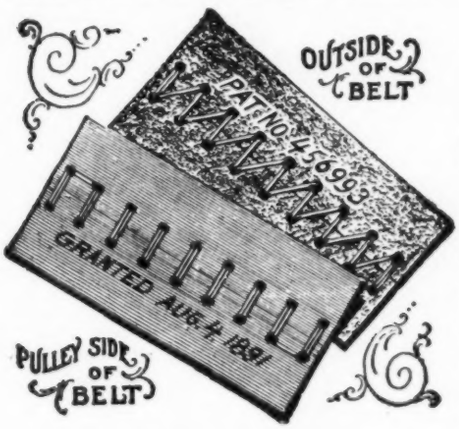
**Worm Hobbing Machines**
Pratt & Whitney Co., Hartford, Conn.

**Worm Milling Machines**
Cleveland Automatic Mach. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

**Wrenches**
Coes Wrench Co., Worcester, Mass.
Greene, Tweed & Co., New York.
Whitman & Barnes Mfg. Co., Chicago, Ill.

**Wrenches, Drop Forged**
Billings & Spencer Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

# KERR'S METALLIC BELT LACING




Kerr's Lacing makes a belt practically endless.

The lace holes never tear out. It will last ten times as long as leather lacing; in fact, one lacing will last about as long as the belt itself.

It is particularly superior for wood working and all rapid running machinery.

The **Quality** is the result of years of active experience in making Belt Lacings and of constant effort to produce an absolutely **flexible** lacing of greatest tensile strength.

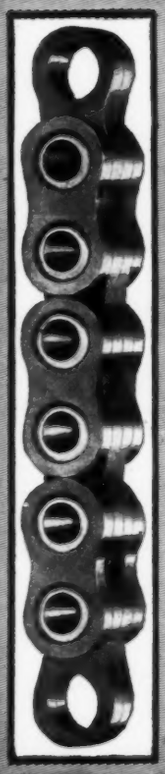
**Ask for descriptive circular No. 1350.**

**WE ALSO SELL THE "A.B.C."** brand, very good, but cheaper. Correspondence invited. Samples upon application. We also carry Rawhide Cut Lacing, Belt Studs, Hooks and Couplings.

## Hammacher, Schlemmer & Co.,

*New Home after August, Fourth Ave. & 13th St.*

**Hardware & Tools, New York City, Since 1848.**



# DIAMOND MACHINERY CHAINS

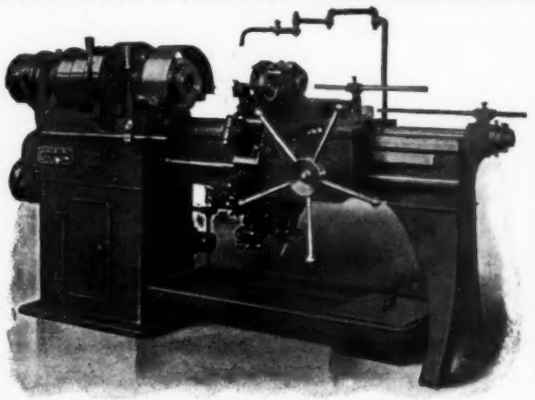
**For power transmission of every kind. Block, Roller, Cable or Balancing, Tubular Rivet and other patterns. Accurate and strong. Correspondence solicited concerning special chain manufacture.**

**WRITE FOR CATALOG.**

**FEDERAL MANUFACTURING COMPANY**
**DIAMOND CHAIN FACTORY—Indianapolis**

## There's One Thing About The "Ring Turret" Lathe that Means Much in Accuracy--The Turret Alignment is Permanent.

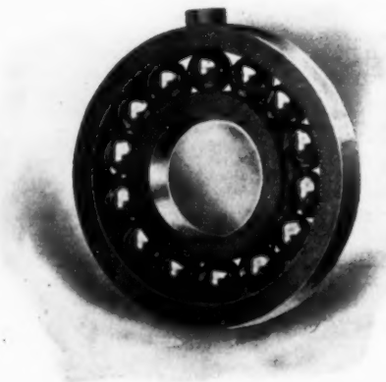
This is the basis of accurate work and is more perfectly attained in the "Ring Turret" than any other turret machine, because the turret revolves on a solid ringway 15" in diam., 45° angle, and is held thereto by a heavy ring gib with mating way 45° angle, accurately scraped to bearings and bolted solidly to carriage with proper provision for taking up wear. This eliminates the effect of lifting stresses from tool on heavy cuts, and this is only one of many good features. Book?



**The Walter H. Foster Company**
GENERAL SALES AGENTS,
**126 Liberty Street, New York.**

Remember

## The Hess-Bright Ball Bearing Does Not Bind



even when a line shaft is not well aligned. After years of service these bearings fail to show any measureable wear; advantage is taken of this fact to leave off all adjustments so that their smooth running cannot be interfered with.

Booklet? Ask.

***The* Hess-Bright Mfg. Co.**
**Pennsylvania Bldg., Philadelphia, Pa.**

## THE ECONOMICAL PRODUCTION OF INTERCHANGEABLE PARTS

is not obtained by devising more and more complicated machinery and manufacturing systems, but by adopting an entirely new process of manufacture—"The Franklin Process of Die Casting"—by which interchangeable pieces are cast to finished sizes, in steel dies, and are ready to assemble as soon as cold. Every one is equal to the best machine made ones, and made with a cheapness, rapidity and accuracy that no other process can equal.

Ask for some samples; they will probably suggest at a glance where great savings can be made in your manufactured articles; ask for copy of "The Cast of a Die," too.

**The Franklin Mfg. Co.,**
200 S. Geddes St.,
SYRACUSE, N. Y., U. S. A.

# The End of Your Shop

can be utilized as well as the rest of your floor space.

# The Robinson Angle Drive

connects shafts running at right angles to each other and transmits power without loss, noise and dirt. It avoids every objectionable feature of bevel gear or mule stand.

Its construction is simple.

Shall we send you a full description?

**Patterson, Gottfried & Hunter, Limited,**
Machinery, Metals, Hardware, Tools and Supplies,
**146-150 Centre St., (Corner Walker), New York City.**

*Printed Occasionally in the Interest of Advertisers in the American Machinist.*

## What This Insert Is.

Simply another way to help our advertisers get better results from their advertising.

Trade paper advertising in general hasn't kept pace with the onward march of advertising.

Trade paper advertisers haven't realized the full advantages of advertising as a selling agency and an aid to the more expensive method of personal solicitation.

We're trying to raise the efficiency and appreciation of mechanical advertising—particularly advertising in the AMERICAN MACHINIST.

We're doing it principally to help *you* get more business through advertising and incidentally to help *us* get more advertising.

We're going to try to dispel some illusions—we're going to suggest practical ways to interest our readers in really meritorious products and then turn their interest into something round and shiny that you can put in the bank—we're going deeper than just publicity—we want you to get *orders*—and lots of them.

For some years we've had an ad.-writing department devoted exclusively to the preparation of good copy and designs for our advertisers.

In this way the effectiveness of the advertising has been materially increased and a weighty burden taken off the advertiser's shoulders without expense to him — but all our advertisers do not appreciate or have not taken advantage of this service.

Good advertising awakens interest and brings inquiries—but you've got to squeeze out the juice—you've got to follow up your inquiries and turn them into orders.

We have reason to believe that many of our advertisers send a catalog or circular when they get an inquiry and quit right there. If they *do* follow the thing up it's in a half-hearted or unsystematic way.

Advertising is a legitimate, productive, dividend-paying investment if it's systematically planned and properly followed out.

System is just as necessary here as in any part of your plant.

When you put advertising on the right basis you've got the greatest commercial power the world has ever known.

We're going to suggest practical, profitable plans, systems, ways and means to help you increase the efficiency of *all* your advertising—catalogs, booklets, folders, circulars, letters, personal solicitation—*everything* that means selling more goods.

We want to be useful and helpful, and we want to grow in size and value.

## A Bob-Tailed History.

The advertisement writing department of the AMERICAN MACHINIST was started seven years ago when the old man himself commenced to write the advertising for the Bullard Machine Tool Co., of Bridgeport, Conn., and the Watson-Stillman Co. of New York.

The idea of getting new copy into every issue grew until the old man was threatened with writer's cramp—then he "hollered" for help.

Mr. A. L. Donnell, the artist of the concern, had developed the ability to get up good ads. and he was put on the job—and he's there yet.

But it wasn't long before he needed help or more hours.

Mr. John Kershaw was the ad. writer for a department store up in New England and wrote some ads. for a plumber that were copied in *Printers' Ink* with favorable comment.

The AMERICAN MACHINIST annexed Mr. Kershaw.

Then we needed a mechanic on the job, and found a young man in a factory over in Brooklyn who was practicing ad. writing at night and worked at his trade the rest of the time. We made him an offer and Mr. Geo. P. Pierce took off his overalls and went to work for us.

But our ad. writing force was still short-handed. What we needed was a professional who had experience in trade-paper work, agency business and in the development of follow-up systems. A fellow that could write a booklet, or invent a plan for an advertiser that didn't just know what he wanted. There was such a fellow at work for an agency that knew that side of the business from a to izzard. We knew he wore good clothes, that his name was A. W. Palmer, and that he'd come high—but we had to have him. We've got him.

Then the head devil in our art department wanted to be an ad. man, and he drew some designs and made picture suggestions, both in colors and plain, that convinced us that he was a better man than the fellow then on the job—and he came over to the ad. writing department.

And there you are. Five men of varied experience, all working together to make the advertising in the AMERICAN MACHINIST better. To make it produce inquiries from real buyers. To, in fact, make the advertising as interesting to a man responsible for results in a machine shop as the editorial.

Here they are, and their services are free to any advertiser in the AMERICAN MACHINIST.

If you want to talk copy, designs, plans, follow-up systems or anything concerning your advertising in the AMERICAN MACHINIST you can consult any one or all of them without putting up a retainer.

The AMERICAN MACHINIST does more for its advertisers than any other engineering or trade paper, and does it differently.

It does not give free puffs, send circulars to a select (?) list, give you tips on the races or issue trading stamps.

But it does a lot of things—and one of them is to "sic" this board of ad. writers on to your ads. and not ask you to pay extra for it.

It costs the AMERICAN MACHINIST money, but the old man believes that the way for the paper to win is to make the advertising win for the men who pay for it.

And this is one of the ways to make advertising win—make it better.

The AMERICAN MACHINIST advertising is better.

# The American Machinist's Advertising Rates.

| | |
|---|---|
| Display Advertisements can be inserted for one time or more at a uniform rate of $2.50 per inch per issue (single column measurement). | $2.50 |
| A discount, of 10 cents per inch per issue, reducing this to $2.40 per inch per issue if paid by 15th of succeeding month, is allowed. | $2.40 |
| Special price for space amounting to 250 or more inches per year, $2.25 per inch for each insertion. Space to be used as desired. | $2.25 |
| Special price for space amounting to 500 or more inches per year, $2.00 per inch for each insertion. Space to be used as desired. | $2.00 |
| Special price for space amounting to 750 or more inches per year, $1.90 per inch for each insertion. Space to be used as desired. | $1.90 |
| Special price for space amounting to 1000 or more inches per year, $1.80 per inch for each insertion. Space to be used as desired. | $1.80 |
| Special price for space amounting to one page (30 inches) for a year. | $1.70 |
| Special price for one page and a half (45 inches) for one year. | $1.60 |
| Special prices for two pages (60 ins.) for one year. | $1.55 |

Special discount of five cents per inch per issue for five-year contracts.

Yearly Rates
for Cover and Special Positions.

| | |
|---|---|
| Outside Front Cover, for each insertion | $100.00 |
| Outside Back Cover Space, yearly per inch. | 150.00 |
| Opp. 1st Page of Reading Matter " | 150.00 |

No man pays one cent more than anybody else who uses a like amount of space.

Here is the form of our contract for 250 inches or more.

Name.. .....
Address.....

To begin ..... 190...
Space..... Inches
$.....

In consideration of a special price of $..... per inch per issue.....agree to use ..... or more inches (single column measurement) space, as desired, during one year from date, in the advertising columns of the AMERICAN MACHINIST, payable monthly as used. No charge for changing copy or cuts. If less than ..... inches are used in the time specified..... will pay the rate for the space actually used as shown on back of this contract. Repeat last ad. when no copy is sent. All conditions are mentioned in this contract.

Dated .....190.... Signed .....

at .....

We call it a contract, because we don't know what else to call it, but as a matter of fact it is nothing more than a memorandum fixing the date for the advertisement to begin, the rate at which it is to be billed, and giving us the advertiser's authority to insert it. It doesn't bind anybody to stay in the paper a minute longer than he wants to. Any advertiser can quit at any time, simply by paying the difference between the price he is paying and the regular price for the smaller quantity of space he has used.

For instance, if you buy 250 inches of space at $2 25 an inch and discontinue your ad after you've used and paid for 100 inches, why you owe us $15.00, just the difference between $2.25 and $2.40 per inch on 100 inches. Of course, if you sign for 250 inches and use 500 inches, you get a rebate check for $125.00 at the end of the year to cover the 25 cents per inch difference between the price for 250 and for 500 inches.

This is our form of contract for less than 250 inches:

Name .. .....
Address.....

To begin.....190...
Space..... Inches
$.....

The publishers of the AMERICAN MACHINIST, World Building, New York, are authorized to insert..... advertisement, to occupy..... inches (single column), to commence with issue of .....190.... for.....times..... and thereafter until forbid by either party in writing, for which.....agree to pay $2.50 per inch per issue. Privilege to discount bill 10 cents per inch, per issue, if paid before the 15th of succeeding month, making the net price $2.40 per inch per issue (if paid monthly). No charge for changing copy. All conditions are stated in this contract.

Dated..... 190... Signed.....

at .....

Our circulation for each issue is printed at the head of our editorial columns, with the total for the year, to and including that number.

We use the same good quality of paper in every sheet that comes from the presses, which means that we do not send copies to advertisers printed on a highly finished paper and use cheap stock for our general circulation.

The weekly issue averages about 112 pages, and the once-a-month edition seldom falls below 176 pages.

The page is of standard size, 9 x 12 inches.

The actual type page is 7 x 10 inches.

With rare exceptions, we divide the page to suit the advertiser. For instance, a half-page may be 7 x 5 inches, extending the full width of the page and half its length; or it may be 3½ x 10 inches, being half the width and full length of the page.

The AMERICAN MACHINIST is mailed every Thursday morning from our plant, at 218 William Street, New York, but the forms close on Saturday morning, and, to have best attention, copy and cuts should reach our business office in the World Building, New York, on Thursday or Friday preceding date of issue.

If proofs are to be submitted for your approval, all matter should be in our hands on Monday or Tuesday, though we can handle them as late as Thursday, if you are not too far away.

Of course, if we prepare your copy, which we do without charge, you know, we send you proofs in ample time for correction and return before the closing of our forms.

# Five-Year Contracts.

Quite a number of our advertisers are now using our straight five-year contract and thus saving five cents per inch on all their advertising.

Why not? Many of them have been in the paper from the first issue and over half of them have been there for more than twenty years.

A good business man doesn't hesitate to sign a lease for five or ten years—especially if his rent comes lower for the longer term.

Advertising is as legitimate an expense to modern selling as an office.

The five-year contract saves us time and expense in hunting up renewals—that's why we give the discount.

There is something substantial about a five-year contract both for the paper and the advertiser. Looks as if the party was in business to stay—which reminds us of a story:

Two merchants in a Western city were fierce competitors and each lay awake 'o nights thinking up schemes to scoop the trade from the other fellow.

One day one of them got out a cloth sign that covered the front of his store: "Great Removal Sale! Everything going below cost before removal! The last chance! Prices absolutely slaughtered!" etc., etc.

The other fellow was surprised, but he was awake, and knew human nature, so he hied him to a sign painter and at 10:30 A M. had his banner on the breeze. It read:

"Great Stay Here Sale. We've been in business here for nine years and have a lease for eleven years more. We sell close but nothing for less than cost. We want your trade now and next year and the year after and will give you satisfaction to keep it. Come in!"

It is needless to say that the "stay here sale" was a success—because the advertiser was honest and made his customers believe he was honest, was going to stay right there and back up all he said and did. People like a permanent thing.

Make your business permanent. Get it on a rock foundation.

Advertising is at least one stone in the foundation under most of the best business houses.

---

If an advertiser cuts down his space is he reducing expenses? If he is reducing expenses is his business reducing? If he is losing business is it because his competitor is getting it? What do the advertisement readers think?

---

You can't get the business with one advertisement—the man who bet he could jump a hundred feet did it in thirty jumps and he got the money.

---

The man who can't afford to advertise can't afford to stay in business—and generally doesn't.

## Some Truths About Technical and Trade Papers.

Every now and then some individual subscriber writes in to his favorite paper and complains that it "carries too much advertising," and suggests a change that he honestly thinks will benefit the paper.

It always surprises these readers when told that if advertising were discontinued his paper would fail even if the subscription price were doubled or trebled.

But it would fail.

Advertising makes the paper go. Makes it possible to hire expensive editors, and pay for expensive engravings and contributions.

It is cheaper for advertisers to pay their little *pro rata* to make a trade paper better, and carry their advertisements to their possible customers, than to seek to reach them in any other way.

The man in a responsible position never objects to advertising—he would object if it were left off.

Take the advertising in the AMERICAN MACHINIST. Is it not the best, latest, most compact, and most carefully indexed set of catalogs a buyer can have?

There is no dead timber in it.

The last issue is always up-to-date.

It's right at hand, and doesn't have to be hunted for and the dust brushed off.

Each month this responsible man looks it over for new things, new arguments, new ideas.

From this advertising alone he becomes familiar with every kind of equipment, compares it with his own, and there is forming in his mind a list of the things he would like to have when the plant is enlarged or renewed.

He becomes familiar with devices he has never seen, knows how they work, and what the maker claims for them.

Then if something gives out, or something new is wanted, *he knows what he wants* and where to get it.

Nothing develops the hunting-and-thinking-about-new-things instinct like responsibility for results.

The individual reader who is interested in the articles and wants the ads. left out has not yet assumed responsibility.

Advertising is the *making known* of things for sale. Now this may shock even some trade paper publishers, but all trade papers are published primarily for advertising.

Their mission in life is to *make known* the better or cheaper or faster way of doing things in the line they represent. These selfsame "things" are purely commercial transactions and are done in the end to make money.

Engineering and mechanical problems may be solved for pure love of the work, but if these efforts are not salable we take notice that their birth rate falls off surprisingly.

Advertising is a part of the selling, introducing, *making known* force, and is just as legitimate an expense as the rent.

Some people mistake other things for advertising, waste their money, and complain—but this does not alter the facts.

A trade paper that does not carry a representative line of advertising about the business it represents is not a real trade paper. If its editorial pages were twice as good and twice as large it would not be worth, to the reader, what another paper in the same field with a large advertising patronage would be.

The trade paper tells its readers how to do things and its advertising pages tells them where to get the things to do with.

A silver-tongued orator who made campaign speeches without advocating men and measures in unmistakable language would not make many votes for his party.

Trade papers are the medium of acquaintance, suggestion and demand, between those who use and those who sell—they lubricate business.

Every successful trade paper is sold to the subscriber—but that subscriber gets a better paper for less money on account of the advertising.

Advertisers in trade papers get a better return for their money from a paid subscription paper—get more interest, more people responsible for results.

Every transaction in business ought to be profitable to both buyer and seller—no permanent business is ever established on any other basis. The trade paper is a modern invention to facilitate business transactions—it's a business in itself—and that's one reason why the one with lots of ads. is the only good one for the reader and the advertiser alike.

---

The trade-paper that gives you a free (?) write-up will do the same for your competitor who makes a poor substitute for your goods.

---

Advertising is the power that makes business grow and the AMERICAN MACHINIST is the best medium for transmitting this power.

---

Most of us get just about what we deserve—advertising for business is pretty good proof that you're entitled to it.

---

Business opportunities may be as thick as flock of wild geese but you've got to have a gun to get the game.

---

Advertising "every now and then" is a good way to waste money. Don't draw your fires every night.

---

Advertising in weak mediums is like gunning for pelicans—you get a big bill and darned little bird.

---

Find the best medium and hang onto it—dabblers don't make successful advertisers.

## Good Copy—Gratis.

We spend over $10,000 a year in the preparation of good copy for our advertisers.

Our ad.-writing department employs four good advertising writers and the best artist that money can hire.

These men do not know how to conduct your business better than you do; nor do they pretend to tell you.

They have, however, given some years to the study of preparing effective advertising, and, in consultation with you, this council of ad. writers can and will produce better advertising than either could do alone.

These men are specialists, with years of experience in handling mechanical advertising.

They make a special study of your proposition and prepare your advertising so as to secure the maximum of benefit at the minimum of expense.

This organization is unique—no amount of money could secure such valuable service elsewhere—but it's gratis to our advertisers.

It relieves you of all the work of preparing copy—all you have to do is furnish us the rough data and criticise the advertising we submit to you.

We want an opportunity to demonstrate what effective advertising we can prepare for *you*.

Fill out the coupon and send it to us with about four copies of your catalog or other printed matter.

One of our experts will put in a day or two studying your literature—he'll analyze your proposition—bring out the strong selling points and lay out a bunch of advertisements for you.

They will reach you in the shape of careful pen sketches so you can see just how they'll show up in the paper.

With them will be a carefully prepared and systematic plan of advertising covering about a year with the exact cost of carrying it out.

This won't place you under any obligations to us.

All we ask is consideration of what we submit and if you decide not to go any further we'll both consider it "a dead issue" until such time as *you* care to revive it.

There is never any charge for writing—special designs are charged at actual cost of the artist's time and the printing plate.

DO IT NOW

FILL OUT, CUT OFF AND MAIL THIS COUPON.

HILL PUBLISHING COMPANY,
WORLD BUILDING,
NEW YORK.

Without cost to us you may prepare and submit advertisements to occupy. . . . . (space) in AMERICAN MACHINIST.

We want to push the following products . . . . . .

We send you catalogs or printed matter under separate cover.

Name. . . . . .

Address . . . . . .

# Follow-Up Systems.

Advertisers in the AMERICAN MACHINIST are invited to ask questions, and send to this department for criticism, plans, booklets, circulars and anything else relative to follow-up work. As many as possible will have careful, earnest attention—no charge.

The greatest problem of all advertising is that of turning inquiries into orders.

Advertisers in the AMERICAN MACHINIST have an effective medium through which to arouse the interest of readers and bring many direct inquiries but the art of kindling that spark of interest into the fire of desire is what brings orders. This is where follow-up work comes in.

As a matter of fact every advertisement after your initial effort is "follow-up" work.

Your first advertisement can do no more than arouse a passing interest, except in very rare cases—iteration and then constant reiteration is what does the business.

General advertisers, selling small priced articles may expect a proportionately large amount of direct results after a few appeals. Advertisers in our line must look more to the cumulative value of their advertising. They can well afford to wait for they get larger prices and relatively larger profits.

* * *

In advertising parlance follow-up work means the following-up of actual inquiries.

Ten years ago this sort of follow-up work was practically unknown—today it is recognized as a most potent factor in a properly planned advertising campaign—but it is still undeveloped.

Many advertisers—notably those using trade papers—neglect follow-up work.

This is a feature of advertising that merits your earnest attention—the advertiser who puts into it the proper amount of time, brains and money will have at his command a mighty selling force and an invaluable aid to personal solicitation.

Follow up every opening to get business until you get the order or prove the case hopeless and you are accomplishing not merely general publicity but bringing actual, tangible results in dollars and cents.

* * *

Your trade-paper advertising turns up your opportunities and your follow-up system makes the most of them.

Your advertisement winds up with "Send for booklet," or some such attempt to find an opening.

There's no sense in spending money to create inquiries and arouse interest unless you persistently follow up your openings.

When the prospecting miner finds indications of gold he digs, and when you find indications of business that's *your* cue to dig.

The value of inquiries can't be overestimated but you've got to turn them into orders to get the dollars.

If there's much competition in your line the prospective purchaser may write to all your competitors, as well as you, and the one who makes the best impression on him gets the order.

* * *

A follow-up system is usually a series of advertising matter—letters, circulars, postal cards, mailing cards, booklets, folders and reply order postals or blanks, sent at intervals varying from three days to a month apart.

Too many follow-up systems are composed entirely of letters.

Mailing cards, odd mailing circulars and folders should usually be alternated with letters for the sake of variety and added effectiveness.

* * *

If you have any idea that a follow-up system is a sort of ready-made affair—forget it quick—every business requires different treatment and only hard study will bring out the points to be considered.

On the amount of profit you make on a sale depends the extent to which you can profitably follow-up an inquiry.

If there's a chance to make a permanent customer on a small-profit article, or one sale with a good profit you're warranted in going in pretty deep.

If you can make but one small-profit sale to each customer you must figure closely.

Consider your profit, expense of securing the inquiry and following it up, and the proportion of dead wood that can only be determined by experience.

* * *

Trade-paper advertising and follow-up work are very effective and economical aids to personal solicitation in cases where they will not actually bring orders.

The salesman's time is too expensive to spend in the educational—the desire-creating part of your selling plans.

Your trade-paper advertising and follow-up system can be made to do the introductory work at a fraction of the cost of salesmen.

Advertising brings the prospective buyer to the point where the salesman can land the order with comparatively little argument.

The progressive salesman appreciates this fact—he realizes that advertising makes his pathway easier, saves his time and increases the value of his services.

* * *

If the returns from your advertising and follow-up work are not what they should be, there's something wrong with *your* advertising or your proposition—not with advertising and the follow-up idea.

One crop failure doesn't prove agriculture a mistake.

Go over the whole ground again carefully, find the weak points and strengthen them.

The follow-up system itself is a profitable exemplification of the old adage: "If at first you don't succeed, try, try again."

If you have the right proposition and present it in the right way you're bound to win.

And when you land your first order you must keep right on—reminding the buyer to send you another, if there's any possibility of his needing something in your line again.

* * *

Before you make any attempt to secure inquiries you should have your follow-up system all ready to put into operation.

The follow-up work must fit into your inquiry-producing machinery and the whole campaign must be thoroughly and systematically planned and executed. You can anticipate many contingencies, others must be provided for through actual experience.

* * *

To facilitate advertising and follow-up work you must have a good reference system to keep track of your work and know just what it is accomplishing.

If you don't know what your advertising is doing you're not getting all out of it that you should.

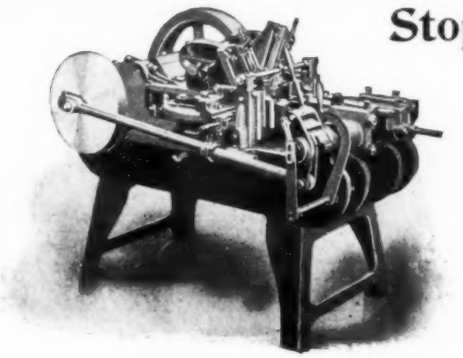
This has popularized the card system and several good filing systems.

* * *

Card and filing systems, successful and unsuccessful plans, general outlines of plans to fit various cases, reaching the agent or dealer when necessary, how to prepare the matter, points on illustrating, printing, mailing, etc., will be considered specifically in future articles in this department.

---

You've got to anticipate a little in making an appropriation for advertising—you've got to base your outlay on the business you hope to do and ought to do. It isn't safe to start out with a two-inch space and the promise to make it four inches at the end of six months if the two inches pay. The two inches will scarcely scratch the surface of the field you want to till, as compared with the large spaces of your competitors; the end of the probationary term will only find you wondering whether it will pay to continue at all, where a space sufficiently large to *command* attention would have brought you to the point of considering even a larger space. Don't spend all the money in sight on advertising—don't go beyond your means; but if you really want business and want it *now*, use space enough to show your product properly and to point out clearly and unmistakably why people ought to buy it. A business card ad. will do only the work of a business card. It will locate you for those who are trying to find you, but it won't sit down at the desk of your possible customer and command his attention like a page ad. or a good salesman.



## Stop Cussing

about the poor heads on those hexagon bolts. Just buy a

**Burdict Six Lever Bolt Header**

and be happy.
We will give you particulars.

**Howard Iron Works,** Buffalo, N.Y., U.S.A.

---

**If Any Wrench User Doubts**

that the Coes Genuine "Knife-Handle" Screw Wrench isn't built for SERVICE—let him try it on the hardest nut he can find. It will not only remove the nut but the doubt also. At all good dealers.

**Coes Wrench Company, Worcester, Mass.**

SELLING AGENTS—J. C. McCarty & Co., 10 Warren St., N. Y. John H. Graham & Co., 112 Chambers St., N. Y.

---

## THE WHITMAN & BARNES MFG. CO.

**FACTORIES:**

CHICAGO. AKRON, OHIO. ST. CATHARINES, ONT.

**BRANCHES:**

CHICAGO. NEW YORK. MINNEAPOLIS, MINN., CINCINNATI.
ST. CATHARINES. KANSAS CITY. 232-234 First St., North. LONDON, ENG.

---

## Producing Planer Profits

on heavy work is easy if you use the right tool.

**Belmer Heavy Planers**

are built solid enough and strong enough to handle any sort of work rapidly and accurately. Built from 30 inches and upwards, any length; 2, 3 or 4 heads. Send for full details.

**Belmer Machine Tool Co., Cincinnati, O., U.S.A.**

---

## SHAPERS Wm. Barker & Co.

CINCINNATI, OHIO.

---

## GAS BLAST FURNACES

For annealing, hardening, tempering, melting, etc. Complete line built on the most improved designs. Catalogue giving full particulars sent on request.

**J. M. WESTMACOTT COMPANY, Providence, R. I., U.S.A.**

---

## This Is Our "CROWN" Grease Cup.

You will notice that it is so constructed that the cap or cover cannot jar off or loosen. By screwing down the cap the lubricant is forced on bearing. Write for prices.

**The Winkley Co., Hartford, Conn, U.S.A.**

---

## Bennett Handy Oilers

can be got at handily in unhandy places. *No plugging up. Oil tight and dust proof.*

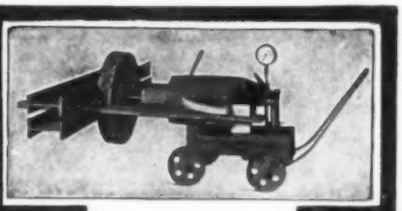
**Bay State Stamping Co.**
WORCESTER, MASS.

Pat. July 21, 1903.

European Agents: Chas. Churchill & Co., London, England.

Pat. July 23, 1901.

---



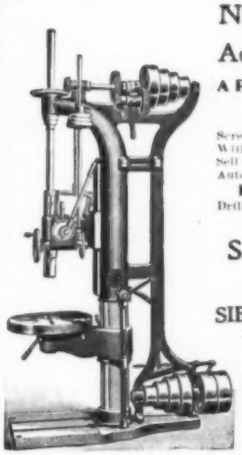
## Every Shop Needs This

portable hydraulic press. It can be wheeled to its work and it is suited to a wide variety of uses, such as removing pins from crank discs, shafting from sheaves and similar work. It is built in different sizes and for different pressures; principally for 60 to 100 tons.

At the price we charge, it easily pays for itself in short order. Circular No. 21 is descriptive and free.

**CHAS. F. ELMES Estab. 1863**
**ENGINEERING WORKS**
250-258 Fulton St., Chicago, Ill., U.S.A.

---



## New 26-in. Drill with Adjustable Head.

**A Powerful Machine. Nicely Balanced. Quickly Adjusted.**

Screw Device operates Table. With or without Back Gears. Self Feed. Reverse motion or Automatic Stop.

**It's a Labor Saver**

Drill Book "C" tells you all about it.

**Sibley Machine Tool Co.,**
Successors to
**SIBLEY & WARE,**
South Bend, Ind.

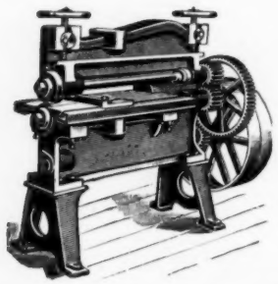
New York agents for export, Markt & Co., Ltd., 195 West St.
Hamburg: 5 Pickhuben.
London: 25 and 26 Shoe Lane, Holborn Circus, E. C.
Paris: 175 Rue du Temple.

---

Agents: Prentiss Tool & Supply Co., New York, Boston, Buffalo, Pittsburg. E. A. Kinsey & Co., Cincinnati, Ohio.

European Agents: Selig, Sonnenthal & Co., London, England.

## For Cutting Sheet Iron and Plates



**There's no shear like the Bethlehem Rotary Shear. It does the work accurately and rapidly—no jar, no noise. Cuts straight lines or circular discs, and will slit square holes in centre or away from edge of plates. Every shear thoroughly tested before it is sent out. Send for Special Shear Catalog.**

## The Bethlehem Foundry & Machine Company

**SOUTH BETHLEHEM, PA., U.S.A.**

---

McCROSKY
ADJUSTABLE REAMERS

F. B. McCROSKY MFG. CO.
MEADVILLE, PA.

---

**Are you troubled** with the dust from your Exhaust Fan? The **Hartford Dust Collector** will overcome the trouble. Send for Leaflet No. 55-S Free.

*In asking for price, give size of pipe from Exhaust Fan*

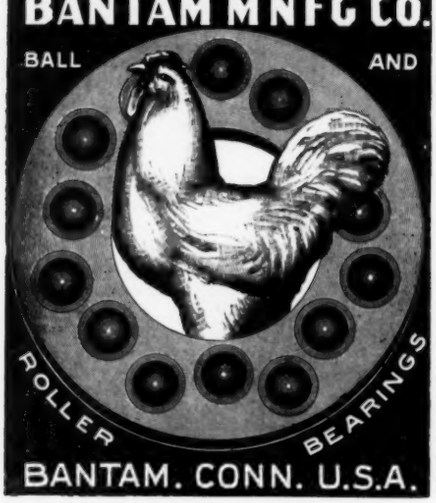
**Blowers. Exhaust Fans, Dust Collecting Systems.**

Heating, Drying and Ventilating Systems. Forced and Induced Mechanical Draft.

**The Hartford Blower Company,**
140 SUFFIELD ST., HARTFORD, CONN., U.S.A.

---

BANTAM M'N'F'G CO.




BANTAM. CONN. U.S.A.

---

The "Little Giant" Taps and Dies are as good as money, brains and best materials can produce. They never go wrong, because they never vary in quality. Have you ever tried them?

## The Name Tap Users Swear By—

*Little Giant.*

**Ask For Free Book.**

**Wells Bros. Company, Greenfield, Mass., U.S.A.**

---

## Our Taps Are "Superior" In Every Way—

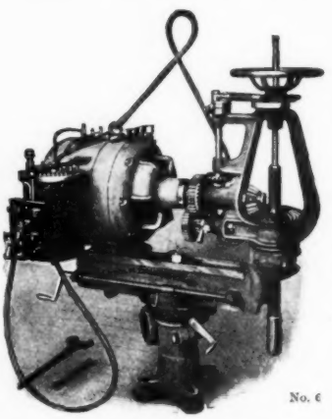
quality, work, shape, uniformity, and name. Don't you want to try a tap that's better than others? Get our Booklet.

**Superior Tap Company, - Springfield, Vt., U.S.A.**

New York Office—Carlisle & Van Gelder, 17 Warren St. Philadelphia Office—F. A. Mitchell Co., 20th and Callowhill Sts.

---

# *Dallett Drills*



No. 6

*Electric Portable for the shop run by electricity. Rope Driven for those not so far advanced. Hand Power for use everywhere; especially adapted for a large range of work that can't be reached by the power tool.*

*THOS. H. DALLETT CO.,*

*York St. & Sedgley Ave., Philadelphia, Pa.*

---

C OLDEST ON THE MARKET!

Carpenter's Taps C

C

QUALITY AND PRICE GUARANTEED.

**J. M. Carpenter Tap and Die Co., Pawtucket, R. I., U.S.A.**

---

## Every Grinder Facility Possible

is embodied in this our "Safety" Emery Wheel Grinder, and that you have use for just such a tool as this there can be no doubt. 'Twill pay to find out about it.

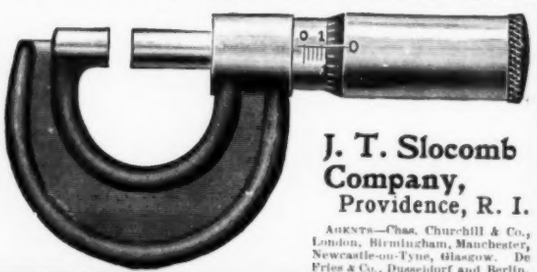
**The Safety Emery Wheel Co.,**
Springfield, Ohio, U.S.A.

Represented by Pfeil & Co., London. DeFries & Co., Act.-Ges., Berlin, Dusseldorf. Adolphe Janssens, Paris, Brussels. V. Lowener, Copenhagen, Stockholm. Adler & Eisenschutz, Milan.

---

## Micrometers For Work and at Prices For Workmen.

Accurate in the extreme. Made with bow of I shaped section which greatly increases their rigidness. Made in sizes from ½ inch to 12 inches opening and come from a shop where accuracy is the first law. The book explains.



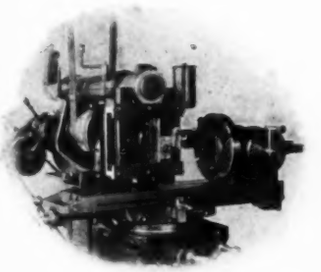

**J. T. Slocomb Company,**
**Providence, R. I.**

AGENTS—Chas. Churchill & Co., London, Birmingham, Manchester, Newcastle-on-Tyne, Glasgow. De Fries & Co., Dusseldorf and Berlin.

# SLOTTING

**Is Done on the Milling Machine**

by using the Rochester Die Shaper. This is an attachment for the Milling Machine that can be put on or taken off in a couple of minutes. With this device all kinds of Die and Shaper Work, as well as slotting, can be economically done. :: Details?



**Rochester Die Shaper Company**
ROCHESTER, N.Y., U.S.A.

**The "Hisey" Hand Drill**

is a handy little portable tool. Is easily carried about the shop. Made in three sizes and will drill holes in metal from 0 to 1/4", 0 to 5/16" and 0 to 1/2". Weighs 14, 16, and 27 lbs., respectively. Power from any incandescent lamp socket. Direct current. Sent on trial.

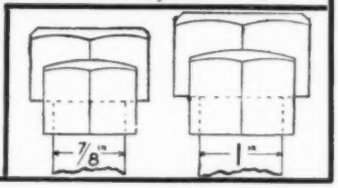
**The Hisey-Wolf Machine Co.,**
CINCINNATI, OHIO, U.S.A.

SET AND CAP SCREWS
STUDS — NUTS
CINCINNATI SCREW & TAP Co.
STANDARD AND SPECIALS.
CINCINNATI, O., U.S.A.
FOR ENGINES AND MACHINERY.

SEND FOR CATALOG.
WORCESTER MACHINE SCREW CO.

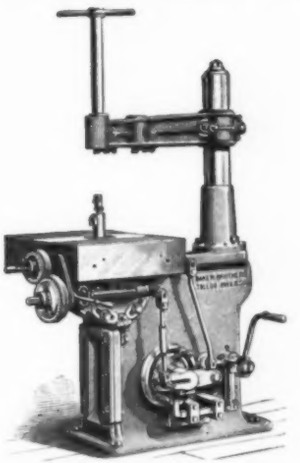
MANUFACTURERS OF
Set, Cap and Machine Screw Studs, &c.

**A Larger Bearing Surface, The Use Of A Cored Hole If You Desire** and at cost to you from us




less than you can do the work yourself makes our Cap Screws with U.S.S. Heads, worth while. Not only are they better in all ways, but they look better and are more easily handled. The list might interest you.

**The Cleveland Cap Screw Company,**
Cleveland, Ohio, U S A

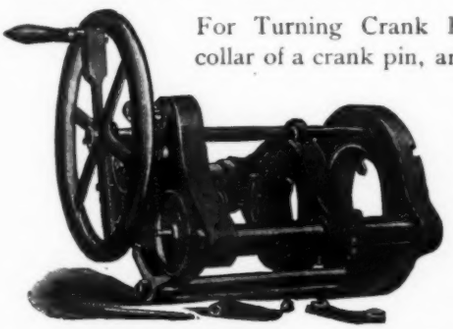


# Keyseater and Slotter

Will cut keyseats, cut internal gears, internal ratchets, oil grooves, miscellaneous slotting, etc., better than any machine on the market.

**Baker Brothers, Toledo, O.**

# Portable Crank Pin Turning Machine

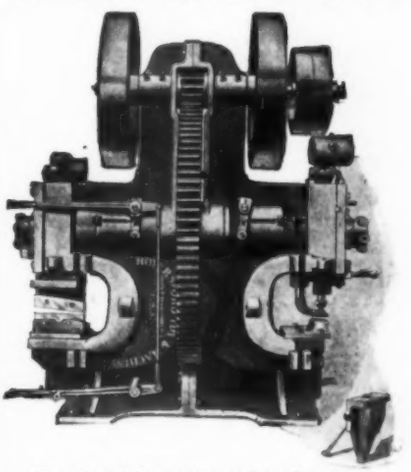


For Turning Crank Pins in position. Goes over the collar of a crank pin, and is adjustable for small pins. It will feed either way. Is strong and durable, and withal, not very heavy. It is held to the wheel by bolts passing between the spokes. Fully described in book.

**H. B. Underwood & Company,**

(L. S. Flanders Machine Works), 1021 Hamilton Street, Philadelphia, Pa.

Our No. 3
# DOUBLE PUNCH and SHEAR



The latest information we have from users of the **ROYERSFORD PUNCH and SHEARS** is that they are good tools and doing excellent service. Need we say more? Numerous sizes for different kinds of work. If you need a machine of this class let us figure with you.

**Royersford Foundry & Machine Co.**
ROYERSFORD, PA.

# Chambersburg Engineering Company

CHAMBERSBURG, PA., U.S.A.

Manufacturers of

**Steam and Steam Drop Hammers, Hydraulic Riveters, Cranes and Accumulators, Forging, Flanging and Hot Presses.**

SEND FOR CATALOG.

**Send for details of construction of our Power Punching and Stamping Presses.**

**FALKENAU-SINCLAIR MACHINE CO.**
107 N. 22d Street, Philadelphia, Pa.

## On Core Work

a Paxson-Warren Sand-Blast Machine will enable you to get at places otherwise inaccessible. It cleans everything cleanable by the sand-blast process and cleans it thoroughly. It is well made and simple.

Send for Circular.

**J. W. Paxson Co.,**
Manufacturers
Foundry Equipment
and Supplies,
1021 North Delaware Avenue,
PHILADELPHIA, PA.

## Eclipse Corliss Engines.

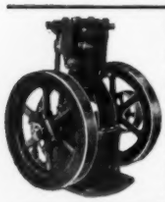
40 to 2,000 H. P. All Styles.

## Ice Making and Refrigerating Machinery.

Engine Catalog E. Ice Machinery Catalog M.

FRICK COMPANY, Waynesboro, Pa.

New York: 39-41 Cortlandt Street.



## Regal Engines

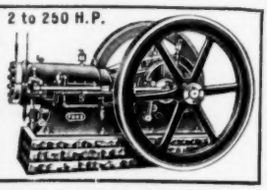
Stationary and Marine. Four cycle type, jump spark ignition. High grade and reliable. A clean cylinder for every fresh charge and spark that is absolutely sure to be made at the right time. Write for catalog 14.

Regal Gasoline Engine Co.,
COLDWATER :: MICH., U.S.A.

## FOOS

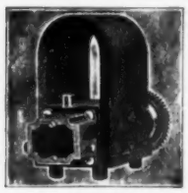
2 to 250 H.P.

For all purposes.
Ask for catalog "M."



The Foos Gas Engine Co.,
Springfield, O.

## REMY MAGNETO IGNITERS

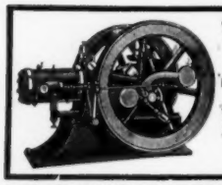


Are suited for use with either touch or jump spark ignition, and in connection with any kind of explosive engines.

Absolutely reliable spark generators and the most simple ignition apparatus manufactured.

Magneto Dynamos, Magneto Oscillators, Magneto Alternator Igniters, jump and touch spark coils, etc.

REMY ELECTRIC CO.,
ANDERSON, IND.



## THE BURGER AUTOMATIC GAS ENGINE

has points of vantage over all others. See Catalog.

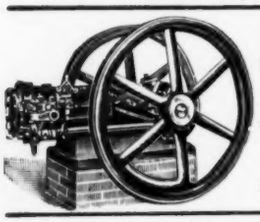
Woolley Foundry and Machine Works,
P. O. Box 500,
ANDERSON, IND., U.S.A.

## HEPPENSTALL FORGE & KNIFE CO.

Successors to
PITTSBURG SHEAR KNIFE & MACHINE CO.

We are now making a specialty of **Forgings** and **Shear Knives** of every description. Your inquiries are solicited.

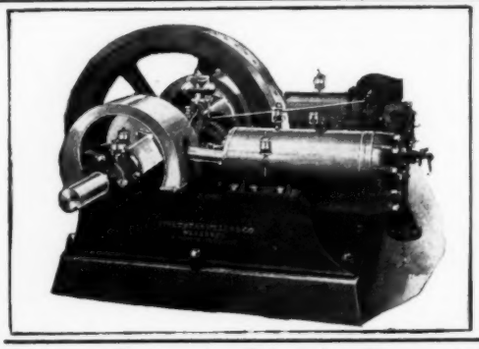
HEPPENSTALL FORGE & KNIFE CO
PITTSBURG, PA.



## NEW ERA GAS ENGINES

2 to 125 H.P.
For Gas or Gasoline.

The New Era Gas Engine Co.,
25 Dale Ave.,
DAYTON, O., U.S.A.



## The Warren Gas Engine.

Awarded Gold Medal at Pan-American Exposition, 1901.

**Single Cylinders, 3½ to 90 Actual H. P.**
**Double Cylinders, 25 to 500 Actual H. P.**

Large sizes in successful operation, driving dynamos for lighting and power purposes. Inquiries solicited for large units to operate with natural, illuminating or producer gas.

**Struthers-Wells Company,**
WARREN, PA.
New York Office: No. 26 Cortlandt Street.

## Your Crank Shaft Troubles and Expenses

are reduced to a minimum when you order from us, because we furnish them finished, ready for use, made from your own detailed drawings, thereby relieving you of all chance for loss in defective forgings or finishing, as we take these chances. We make a specialty of these articles, and are prepared to furnish them from a good grade of open hearth steel, and finished exact to dimensions specified. The same is also true of our finished valve stems, made to order only. Send blue prints, and state quantities desired, for prices.

**Standard Connecting Rod Co., Beaver Falls, Pa., U.S.A.**

## Schieren's Weekly Advice:

*Turn a bargain over before buying.*

Don't be satisfied with the looks of things, especially leather. Belting is a doubtful purchase unless it is made by a well known firm.

## Buy Schieren Belting

and you will be sure that leather and making are both right. Get our Dixie Belt Leather Book.

41 Ferry Street,
Chas. A. Schieren & Co., New York

Boston—190 Lincoln St. Chicago—90 Franklin St. Pittsburgh—238 3d Avenue. Phila.—224 North 3d St. Hamburg—Pickhuben 4. Denver—1313 16th St.

## The Mietz & Weiss Oil and Gas Engines

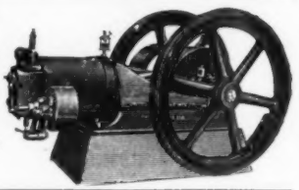
**Standard and Marine 1-60 H.P. (Constant Thrust)**

Adopted by the U. S. and foreign governments. Most economical and safest power known. Runs with common kerosene, distillate or fuel oils. It will pay you to consult me before placing your order elsewhere. For Pumping, Electric Lighting, Charging Storage Batteries, and all other power purposes. Hoists, Pumps, Air Compressors, Portable Engines, Dynamos. Highest award for direct coupled engine and dynamo, Paris Exposition, 1900. Gold Medal, Pan-American Exposition, 1901. Gold Medal, Charleston, S. C., Exposition, 1902.

A. MIETZ, 128-138 Mott Street, New York
Send for catalog, Dept. 85.

## "Jacobson" Gas and Gasoline ENGINE

5 to 300 H. P.



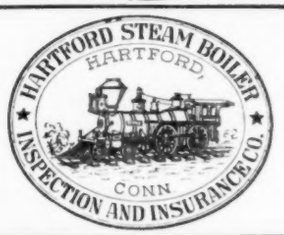
Jacobson Machine Mfg. Co.,
WARREN, PA., U.S.A.

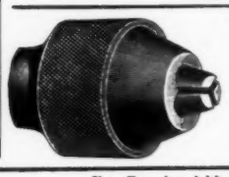
The OLDS Gas and Gasoline Engines.

Strength is paramount. Simplicity is assured by correct design and economy is demonstrated by a perfect understanding of the proper explosive mixture, and the means to obtain it.

STATIONARY ENGINES, 2 TO 100 H.P.
PORTABLE ENGINES, 8 TO 12 H.P.

Olds Gasoline Engine Works,
228 RIVER ST., LANSING, MICH.



## Almond Drill Chuck.

Sold at all Machinists' Supply Stores.

T. R. Almond,
83 & 85 Washington St.,
Brooklyn, N. Y.

## Backus Gas and Gasoline Engines

Cheapest Power Known.

For Circular Address
Backus Water Motor Co.,
Newark, N. J., U. S. A.

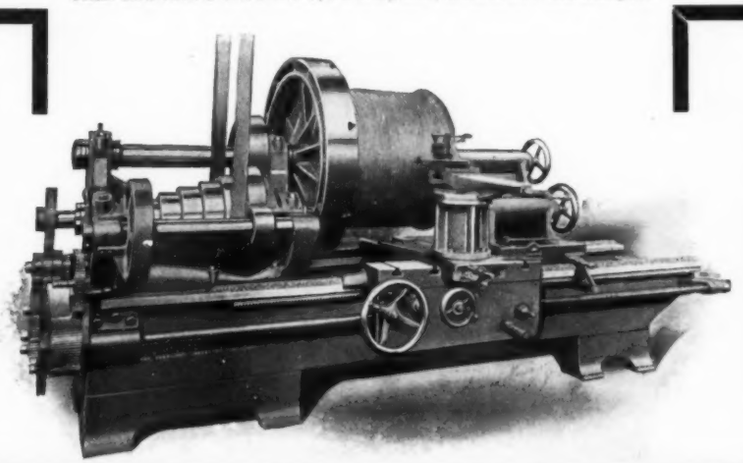
## About Any Sort Of Lathe Job Can Be Handled On One Spindle Or The Other

**Of McCabe's New "Heavy Pattern" 26″–48″ Double Spindle Lathe.**

And this wide range of usefulness—this capacity for big work on the 48″ spindle, and light work on the 26″ spindle—means that this lathe is an especially good one to buy, especially as it costs about half what an ordinary big lathe would, and gives all the advantages of two lathes while occupying the usual floor space of one. Send today for our catalog. Don't wait to hunt through second-hand lists, for these tools won't be found on them—they're too busy working.

**J. J. McCabe, 14 Dey Street, New York City.**

Chas. Churchill & Co., London, Birmingham, Manchester and Glasgow.



## Special REED Lathes.

Besides our Standard line of Lathes we make Lathes for special uses such as Chucking, Facing, Forming and Reducing. Full list with descriptions, on application.

**F. E. Reed Co., Worcester, Mass.**

CUMBERLAND STEEL COMPANY
TURNED AND GROUND CUMBERLAND, MD.
HIGHLY POLISHED SHAFTING. U.S.A.

If not yet "out of the woods" on the roller bearing proposition, send for our new booklet,

**"THE REASON WHY."**

**HYATT ROLLER BEARING CO.**
HARRISON, N. J.

**Automatic Machines**

for making Stove Bolts, Tire Bolts, Rivets, Lag Screws and Wood Screws.

**ASA S. COOK CO.,**
Hartford, Conn., U.S.A.

**The Fairbanks Planer Tool**

For the economical use of Self-Hardening Steel in planer and shaper work. One of these tools takes the place of a complete set of solid forged tools, is always ready and being so made that cutting is done without vibration, affords the best service possible. Book tells all.

**The Fairbanks Mach. Tool Co.,**
**Springfield, O., U.S.A.**

WITH A
**Forbes Patent**
DIE STOCK
ONE MAN
can with ease cut off and thread a 12 inch pipe.

No. 56 Hand Machine. Range 2½—6 in. R. H.

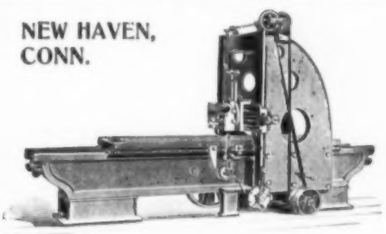
**Smaller Sizes Proportionately Easy.**

Catalog on application.

**THE CURTIS & CURTIS CO.**
66 Garden St., BRIDGEPORT, CONN.

## NEW HAVEN MFG. CO.

NEW HAVEN, CONN.



MANUFACTURERS OF
**IRON WORKING MACHINERY.**

MACHINERY and MECHANICAL APPLIANCES
EXHIBITED AT
THE BOURSE
PHILADELPHIA
ATTRACT THE ATTENTION OF
BUYERS

Write For Further Information.

**There's No Figuring or Bother with the Mueller Patented Radial.**

For instance, there is a speed plate that shows exactly the proper speed for any sized drill from ¼ in. to 2½ in., and a lever conveniently placed affords the speeds without trouble. This is only one of the many advantages. The book tells of all.

**Mueller Machine Tool Co.**
**Cincinnati, Ohio, U. S. A.**

**Grant Gear Works, Inc.**

8 Portland St., Boston, Mass.

**Gear Wheels and Gear Cutting**

Grant's Illustrated Catalogue free

BEVEL GEARS, PLANED TEETH, RAW HIDE PINIONS, FORGED STEEL PINIONS, GEARS OF STEEL CASTINGS, CAST IRON GEARS.

Hurry Orders and Break-Down Jobs special attention.

**Philadelphia Gear Works, Inc.**

7TH AND CHERRY, PHILADELPHIA, PA.

Geo B. Grant, the "Gear Pilot," President. Full of Information, Free.

GRANT'S GEAR Treatise, a Dollar, worth Ten.

It is We make **GEARS** that make the world go round.

Anything you want in that line.
Catalogue free. Treatise, $1.00.

**Cleveland Gear Works, Inc.**

35 Michigan Street, Cleveland, Ohio.

**Sawyer Gear Works**

227 St. Clair St., Cleveland, O.

Gears { of all *kinds* and *sizes* in stock and made to order.

From—the cheapest that's *good*

To——the *best* that's made.

Sample our Workmanship.
Get our Prices.

**Bevels, Spurs and Internals**

with perfect planed teeth, Spirals, Worm Gears, Worms, Sprockets, Chains, Elliptics, High Speed Steel Cutters, Large Stock of Gears on hand for prompt shipment, Universal Joints.

Send for Catalog R.

**BOSTON GEAR WORKS**

BOSTON, MASS.

**Gearing** OF ALL DESCRIPTIONS.

The Earle Gear & Machine Co,
Oxford and Mascher Sts., Philadelphia.

**Single Cut Bevel Gear Cutter.**

This Cutter will cut good, strong, smooth running Gears at one cut or operation. Made for any pitch or number of teeth. For particulars and prices address

R. M. CLOUGH,
Tolland, Conn.

**WORM GEARING.**

**The Albro-Clem Elevator Co.**

See Issue June 23. PHILADELPHIA, PA.

MEISEL PRESS & MFG. CO.,
944-948 Dor. Ave., Boston, Mass.

*Builders and Designers of Special*

MACHINERY and PARTS.

Gears and Gear Cutting—Sprockets and Chain.

*Machine and Tool Grinding of all Kinds.*

**THIS TRADE-MARK**

on a raw hide pinion corresponds to the Sterling mark on silver—it denotes the highest degree of perfection.

New Process Raw Hide Pinions are the recognized standard of excellence. Owing to patent and secret processes of curing the raw hide, they contain much more of the vital fibre than other raw hide, and **wear like iron.**

They provide a **noiseless positive drive**—no noise, no loss of power. Get our free booklet for the facts.

We also make accurately cut and planed Metal Gears, in Spurs, Bevels and Internals.

**THE NEW PROCESS RAW HIDE CO.,** SYRACUSE, N. Y.

MORRIS & WALES, PHILA.

**2,000 and More Styles**

we make regularly in Gears (patterns always in stock) but if the kind you want isn't among 'em, we can make it for you if you'll tell us what you want. The Gear will be right and so will the price. Truck wheels, too. Catalog?

**I. & E. Greenwald Co.,**

720 E. Pearl St., CINCINNATI, O.

**Chicago Rawhide Mfg. Co.,**

*94 Ohio Street, Chicago.*

**Rawhide Pinions and Blanks.**

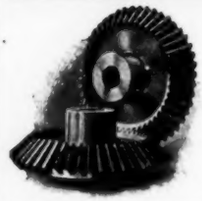
*139 Congress St., Boston.*

**Rawhide Belting, Lacing-Rope**

"They Will Be Worth

the extra cost over cast tooth gears"—so says one of our customers. We do not make cast tooth gears, but we make Cut or Planed Tooth Gears that are correct, at small cost over cast tooth gears.

R. D. Nuttall Company,
Pittsburg, Pa.



**Bevel Gears Planed**

to 24" Diameter.

**Spur Gears** to 84" Diameter.

**Foster-Kimball Machine Co.,**

71 Fulton St., Chicago, Ills.

**The Gear Shaper Cutter**

never "breaks out" the metal of the blank in passing out, because it has a top rake, giving a shearing cut, and, on account of the crank motion, leaves the blank at a minimum cutting speed. And, then, the finishing portion of the cut is the thin portion of the chip.

Want other details?

**The Fellows Gear Shaper Co.,**

SPRINGFIELD, VERMONT.

**SIMONDS GEARS LAST**

longer than the machinery and are silent running.

A trial convinces.

Send specifications.

**The Simonds Mfg. Co.,** Pittsburg, Pa., U.S.A.

**Scranton Power Hammers** PRODUCE FORGINGS AT LEAST POSSIBLE COST. Send for Particulars. THE SCRANTON & CO. NEW HAVEN, CONN.

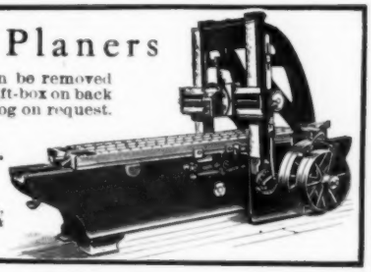
## We take our own medicine--

Equip all our machines with Fawcus Cut Gears, because we make them and know they are cut correctly and are superior to other gears. We're just as anxious as other people to save power and the wear and tear on machinery.

**Fawcus Machine Company,** 28th Street, Pittsburg, Pa.

## Woodward & Powell Planers

Intermediate shaft in 3⅜" and smaller sizes, can be removed from planer bed, with large intermediate gear, shaft-box on back side, and rack-gear pinion all in contact. Catalog on request.



Woodward & Powell Planer Co.
Worcester, Mass., U.S.A.

Robinson & Carey Co., St. Paul, Minn.; Milner & Kettig, Birmingham, Ala.; W. M. Pattison Machinery Co., Cleveland, O.; Manning, Maxwell & Moore, New York City, Philadelphia, Pa., and Chicago, Ill.

## Here's an Emery, Water Tool Grinder

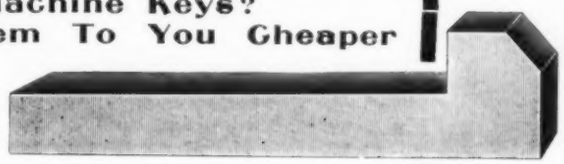
That will afford you that grinder satisfaction you have so long sought. Its initial cost is small and right; at this point costs cease. No trouble. All details on request.

**Northampton Emery Wheel Co.,**

20 South Canal Street, Chicago, Ill.

Leeds, Mass., U.S.A.

## Why Make Machine Keys? We Sell Them To You Cheaper



than you can make them, unless you are equipped with special key making machinery. We use the best material, and will guarantee any degree of accuracy you require. It will only cost you a post-card to get catalog with prices.

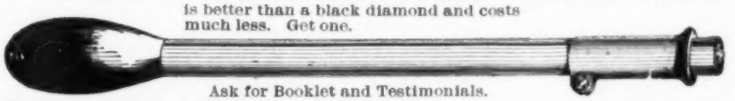
**STANDARD GAUGE STEEL COMPANY,**
Beaver Falls, Pa., U.S.A.

# SHAPERS

***The* John Steptoe Shaper Co., Cincinnati, O.**

## THE DESMOND DIAMO-CARBO EMERY WHEEL DRESSER

is better than a black diamond and costs much less. Get one.



Ask for Booklet and Testimonials.

**THE DESMOND-STEPHAN MFG. CO.,** Urbana, Ohio.

## Magnetic Separator

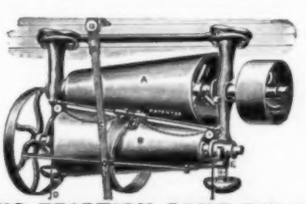
for removing steel from brass scrap, iron from foundry sand, emery, etc.

Brass stock cleaned with this machine can be used for best work. Machine will pay for itself in labor saving alone.

*3 Sizes. 1,500 daily capacity and upwards.*

**Ezra Sawyer, Manfr.**
31 Hermon Street, Worcester, Mass.

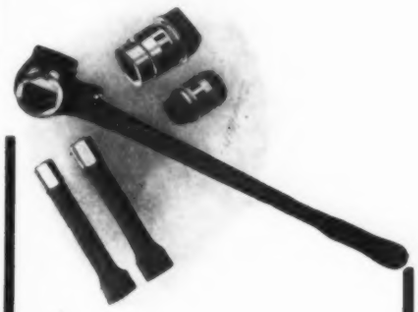
J. W. Paxson Co., Sales Agts. Philadelphia, Pa.



**EVANS FRICTION CONE PULLEYS**

Changing Speed of Machine while Running
Send for Catalogue

**1288 Center St., Newton Center, Mass.**



## The "Favorite" Wrench

### Works Where Other Wrenches Can't.

The ratchet enables you to turn nuts and bolts on which you couldn't use an ordinary wrench. Fits any nut and stays on till the nut is seated or removed.

Nut is braced on all sides so the wrench can't slip and chew off the corners.

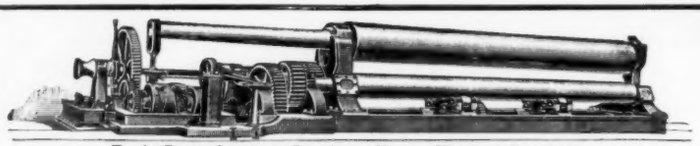
To reverse the "Favorite" Wrench you simply turn a pawl.

The Ratchet Drill Attachment is mighty convenient, too.

Our catalog B will tell you all about it.

Send for a copy.

**Greene, Tweed & Co.,**
Manufacturers,
17 Murray St.,
New York,
U. S. A



Tools Built for Any Service. Heavy Work a Specialty.

**PLATE BENDING MACHINERY.**

**BENDING ROLLS.**

Horizontal or Vertical Type. Engine or Motor Driven.

**WICKES BROTHERS,**

Main Office and Shops at Saginaw Mich.

95 Liberty St., New York. 45th & A. V. R. R., Pittsburg. Marquette Bldg., Chicago.

## Keyseats Cut On The Catlin

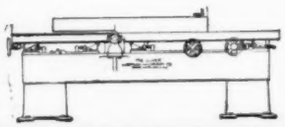
are accurately cut and cut in almost no time, so it doesn't cost you much for keyseats if you have a Catlin about the place.

**Chattanooga Machinery Co.,** Chattanooga, Tenn., U. S. A.

Agents for Great Britain, The Niles Tool Works Co., 23 and 25 Victoria St., London, S.W. Canada, H. W. Petrie, Toronto, Ont.

## "OLIVER" HAND PLANER, OR JOINTER.

Send for Detailed Description.



**OLIVER MACHINERY CO.,**

Successors to AMERICAN MACHINERY COMPANY,

**16 Mill St., Grand Rapids, Mich., U.S.A.**

**Makers of "OLIVER" Wood Trimmers, Universal Saw Bench, Hand Jointers, Band Saw and Wood Lathes**

Mention this ad in writing us. **Branch Office, No. 10 Deansgate, Manchester, Eng**

## THE AMERICAN WROUGHT STEEL PULLEY.

There is nothing that approaches the American in Design, Strength, Convenience or Durability.

Perfectly safe at high speeds. Fits all sizes of shafting. Sold by the best supply houses.

MANUFACTURED BY

**THE AMERICAN PULLEY CO.**

29TH AND BRISTOL STS.,

**PHILADELPHIA, PA.**

## Eureka Flexible Back Hack Saw Blades Won't Snap

Or break, the soft back prevents this and allows you to get full value from your blades.

Catalog 10 shows all kinds of hack saw devices.

**HENRY G. THOMPSON & SON CO., - NEW HAVEN, CONN., U. S. A.**

## Extra Heavy Rough Brass Unions

**And BRASS CASTINGS For All Purposes.**

Phosphor Bronze for Machine Box Bearings, Etc.
Special Finished Brass Work to Order.

**NOLTE BRASS CO.,** P. O. Box 583, SPRINGFIELD, O.

## SHAPERS

12 to 32 In. Stroke. Manufactured Exclusively.

**SMITH & MILLS,**

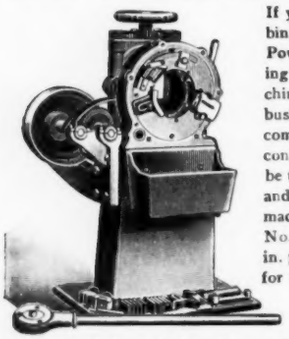
Cincinnati, Ohio, U.S.A.

## Chucking Tools on the Floor

is one way, but the better way—the "New Britain way," is to put them on this rack and keep it next to the forge where every tool is handy when you want it. There's a rod around the edge for hanging fullers, flatters, tongs, etc., an upper tray for small tools, a lower tray for work and a drawer for private tools. Built with three trays if desired and with ball-bearing casters or feet. It's a good rack and doesn't cost much. Send for Catalog.

**New Britain Machine Co.,** New Britain, Conn.

## BUY THIS ONE



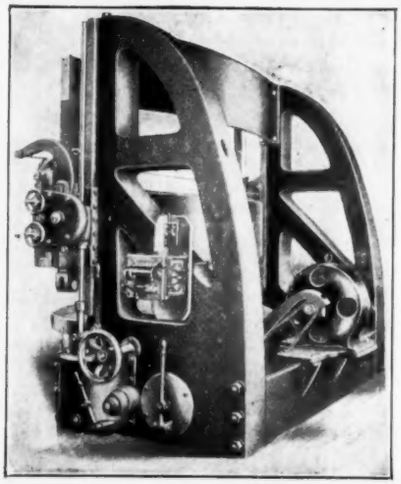
If you want a Combination Hand and Power Pipe Threading and Cutting Machine that's built for business. Driven by compound gear with cone pulleys, and can be taken off its base and used as a portable machine. Two sizes: No. 5½ for 1 in. to 4 in. pipe, and No. 6½ for 1 in. to 6 in. pipe.

Catalog No. 5 gives full description and shows the best line of pipe threading and cutting machinery under "the canopy."

**The Merrell Mfg. Co.,**

**100 Curtis St., Toledo, Ohio.**

EUROPEAN OFFICE:
The Fairbanks Co., 78-80 City Road, London, E. C.



THIS IS

## The Poole 10-Foot Boring Mill,

for motor driving. Has *cross rail-elevating mechanism*, operated by the motor, which also takes care of traversing the tool heads and raising and lowering the tool bars.

Speeds and feeds are instantly changed by lever and hand wheels. Range of table speeds from 1-2 to 24 revolutions per minute.

For larger cut and further description, see page 474 of The American Machinist—then send for circulars.

**The J. Morton Poole Co.,**

WILMINGTON, DEL.

Beds any desired length
Cutting all threads without stopping Lathe or reversing the Lead Screw.
HIGH GRADE TOOLS.

## ENGINE LATHES

17 INCH, 19 INCH, 22 INCH and 24 INCH SWING.

BUILT BY

**GREAVES, KLUSMAN & CO.,**

N. E. Cor. Cook and Alfred Sts.

**CINCINNATI, OHIO, U. S. A.**

ALSO BUILDERS OF

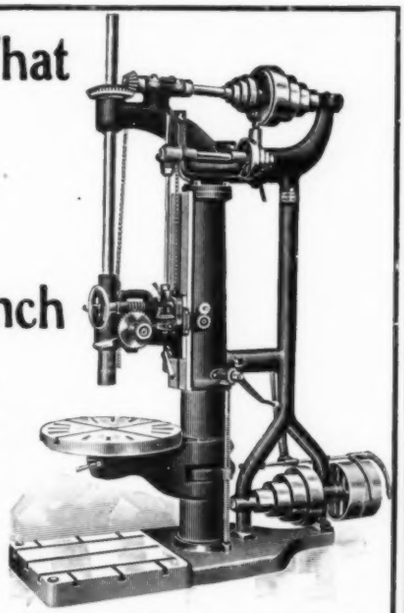
PATTERN MAKERS' LATHES AND MACHINERY AND METAL SPINNERS' LATHES.

## An Upright Drill That "Fills The Bill"

in every way and that will be found as convenient as it is capable, is this

## B. F. Barnes 31-Inch

This drill is built with back gear, power feed and automatic stop. The feed mechanism gives hand worm feed and quick return of spindle; all of which, with other features are described in our catalog.



**B. F. Barnes Company,**
**Rockford, Ill., U.S.A.**

FOREIGN AGENCIES—Belgium, G. & F. Limbourg Freres, Brussels. France, Henry W. Peabody & Co., New York. Asia, New York Export and Import Co., New York. Victoria, Australia, Thomas McPherson & Son, Melbourne. Ontario, Canada, H. W. Petrie, Toronto.

## TURRET MACHINERY

Our complete line of machine tools—including

The Hollow Hexagon Turret Lathe,
The 30 Inch Vertical Turret Machine,
Screw Machines,
Turret Lathes,
Brass Working Machinery, etc., etc.—

fully illustrated and described in our General Catalog and other booklets.

We shall be pleased to send you any or all of these catalogs. State in which machines interested.

**THE WARNER & SWASEY COMPANY,**
**CLEVELAND OHIO, U.S.A.**

## Anyone Can Engrave With This Engraving Machine Of Ours.

It doesn't take an expert to operate it, so you not only save the cost of a high priced man, but the ordinary workman can turn out work better than the most skillful hand engraver in a fraction of the time the hand workman would take. It is for engraving name and direction plates and similar work. Details on request.

**Geo. Gorton Machine Company**
Racine, Wis.

## D. SAUNDERS' SONS,

**Steam and Gas Fitters' Hand Tools,**

24 Atherton St.
Yonkers, N. Y.

Send for Circular.

Manufacturers of
**Pipe-Cutting, Threading and Tapping Machines.**

**The Patent Wheel Pipe Cutter** shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel, hardened. Less friction of parts than any other pipe cutter made.

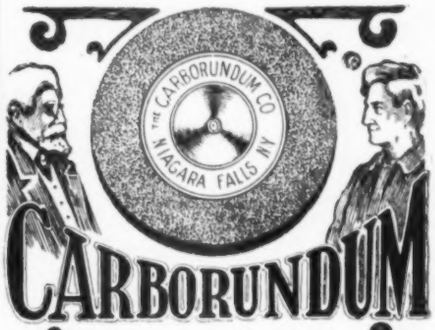
## If Your Time Is Of No Special Value

You'll have no use for Nicholson Expanding Mandrels. If, however, time to you is money, as it is to most folks, you cannot get a line to us too quick making inquiries.

A set of Nine Nicholson Expanding Mandrels fit every sized hole from one inch to seven inches, and take the place of piles of ordinary solid mandrels.

**W. H. NICHOLSON & CO.,**
WILKES-BARRE, PA., U.S.A.

*Foreign Agents*—C. W. Burton, Griffiths & Co., London Schuchardt & Schutte, Berlin, Cologne, Vienna, Brussels, Stockholm, St. Petersburg.




Workmen know a good thing when they see it—
So do Progressive Manufacturers—

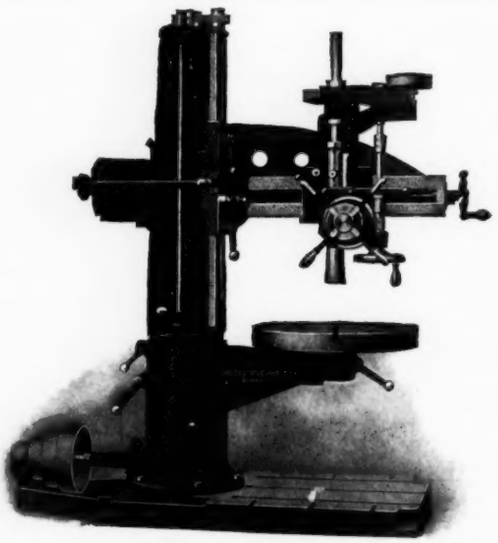
CARBORUNDUM CO.,
Niagara Falls.

*Gentlemen*—We have tried about every kind of grinding wheel, and find Carborundum decidedly the best. Our piece-workers will accept nothing else, as they find that Carborundum is a very ready cutter—requires no dressing and that it will turn out at least a third more work than is possible with an Emery wheel.

Yours truly,
THOMAS KANE & CO. WORKS.
Racine, Wis.

*Write for the Booklet.*

**The Carborundum Company**
**NIAGARA FALLS, N. Y.**



REPRESENTATIVES—Manning, Maxwell & Moore, New York, Boston and Chicago. Carey Mchy. & Supply Co., Baltimore. Prentiss Tool and Supply Co., Pittsburg. Wm. C. Johnson & Sons Mchy. Co., St. Louis. Pacific Tool & Supply Co., San Francisco and Hawaiian Islands.

Selig, Sonnenthal & Co., London. C. Schinz, St. Petersburg. E. Sonnenthal, Jr., Berlin. G. Koeppen & Co., Moscow. V. Lowener, Copenhagen and Stockholm. Van Rietschoten & Houwens, Rotterdam. Wilh. Sonnesson & Co., Malmo, Sweden. Stussi & Zweifel, Milan, Italy.

**THIS IS THE**

# RADIAL DRILL

**SIMPLE IN CONSTRUCTION**

BUT HAS MORE

## TIME AND TOOL SAVING FEATURES

THAN ANY OTHER.

Four changes of semi-geared feed.

High and low tapping speed by quick reverse.

Device to prevent taps from breaking when over-strained.

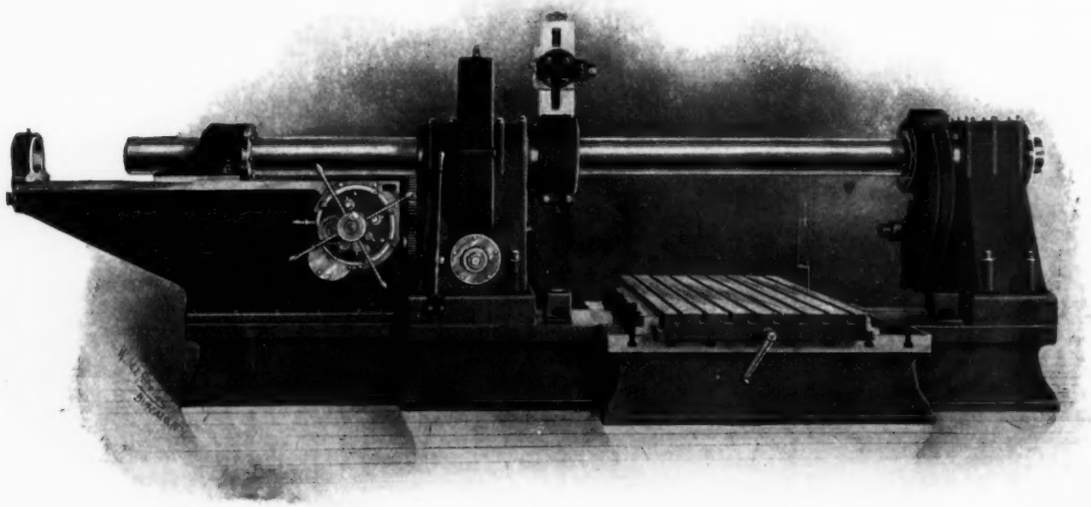
Four operative quick return levers.

Automatic stop and depth gauge.

All operated while drilling.

We make the most complete line of all sizes and styles.

**DRESES MACHINE TOOL CO., Cincinnati, Ohio, U. S. A.**



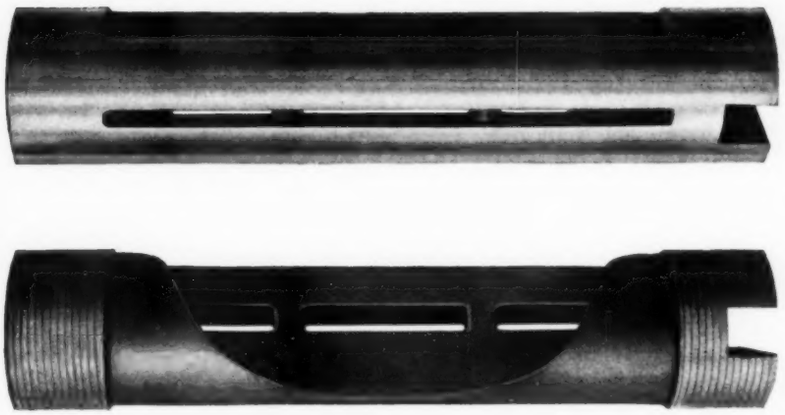
# Barrett Horizontal Cylinder Boring Machines

**OF ALL SIZES.**

**Address Catalogue Dept.**

**MEADVILLE VISE CO., MEADVILLE, PA.**

# EXHAUST VALVE.



Size: 26″ long, 5½″ diameter.

Turned from rough casting ONE CUT 4 PITCH, reduction in diameter ¼″, TIME 10½ MINUTES.

Ground from above turning in Norton Plain Grinder, reduction in diameter 1-32″, time 30 minutes.

Total time from ROUGH CASTING to FINISHED GROUND VALVE 42 MINUTES.

## THINK THIS OVER.

**Can you do as well as this with the machines you have?**

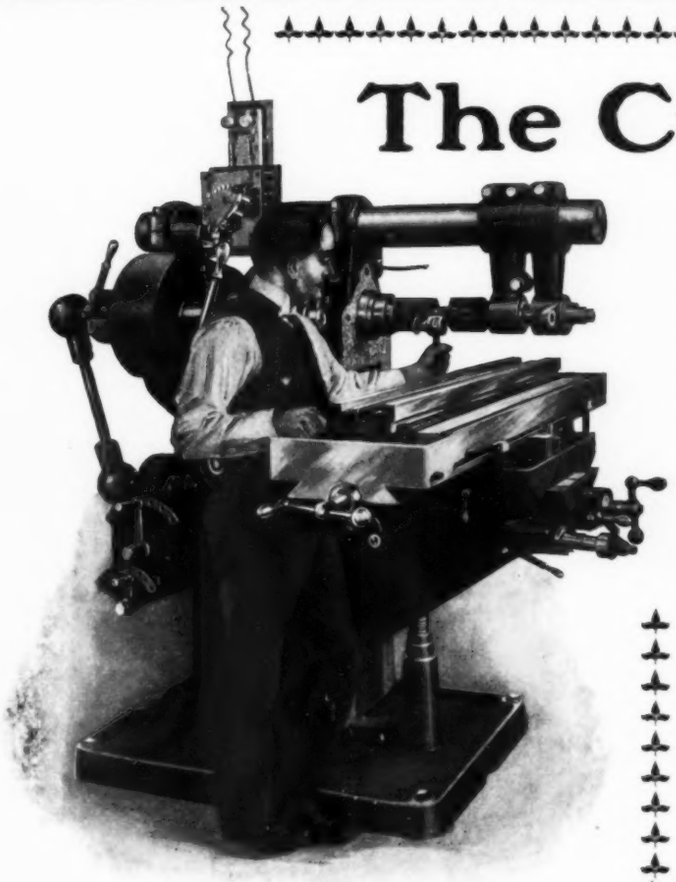
REMEMBER this is a nice ground surface, not an irregular surface from a broad nose turning tool or a file. Others are using our Grinding Machines in connection with high-speed turning.

**BETTER GET INTO LINE.**

## Norton Grinding Co., Worcester, Mass.

Ludw. Loewe & Co., Ltd., London, Berlin, European Agents.

# The Cut-Meter



Does away with guessing at the speed of cutting tools. No matter how good a guesser you are, guessing is no way to conduct shop operations, and the sooner you cut it out the sooner you'll get down to a real knowledge of "where the profits are goin'." A knowledge of speeds at which your tools are running—a positive knowledge, such as the Cut-Meter affords—enables you to correct things and have them just right. The Cut-Meter shows instantly the speed of moving tools, and in feet per minute, regardless of diameter, or whether the motion be rotary or otherwise. It has no attachments, doesn't have to be set in any way, will work upside down or in any position, and catalog describes.

## Warner Instrument Co.

**51-59 Roosevelt Avenue**
**Beloit, Wis., U.S.A.**

New York, 39 Cortlandt Street.
143 Federal Street, Boston, Mass.

## Sebastian Lathes

When you put a small piece of work on a big lathe you're *wasting* money—when you put it on a Sebastian Lathe you're *making* money. Put all your work, from 15″ swing down, on a Sebastian Lathe and you get absolute accuracy and rapidity that means profit.

Our catalog of engine and foot lathes is full of reasons why it will pay you to put in a Sebastian Lathe.

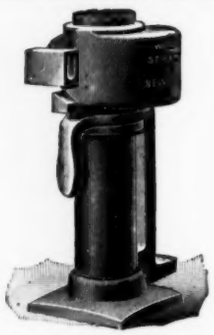
**SEBASTIAN LATHE CO.,**
117-119 Culver St.,
**Cincinnati, Ohio, U.S.A.**

**Adjustable Reamers**

The blades are tightly driven into dovetail slots and unevenly spaced, by driving toward the shank they are expanded to compensate for wear. Four standard styles and all sizes carried in stock.

**The John M. Rogers Wks.**
GLOUCESTER CITY, N. J.

## This Little Jack Can Lift Seven Tons



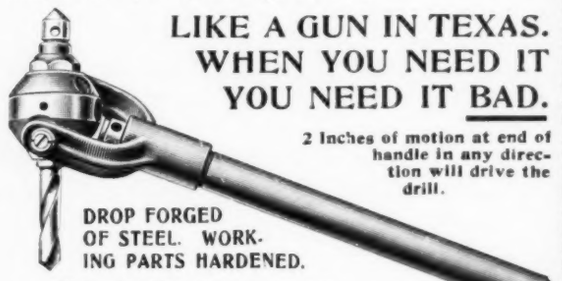
It's only 13 inches high and it weighs just about 46 pounds but that merely shows what "W & S" Jacks can do. This Jack doesn't demand a special position to work in, either, but will operate to its full stroke horizontally as well as vertically. Maybe this isn't exactly the kind of Jack you need, but as we have 250 and more varieties of Jacks we can supply just your style without making you wait a minute for it. Might as well send for our reading matter anyway.

**Watson-Stillman Co.**
**46 Dey St., New York City.**
Works: Aldene, N. J. Chicago Office: 453 Rookery.
Selig, Sonnenthal & Co., London.

## ARMSTRONG UNIVERSAL RATCHET

Patented Nov. 8, 1898, and Sept. 29, 1900.

The Armstrong Universal Ratchet will drive a drill in any position where it is possible to move the handle, either in a vertical or horizontal direction or at any intermediate angle.



**LIKE A GUN IN TEXAS. WHEN YOU NEED IT YOU NEED IT BAD.**

2 inches of motion at end of handle in any direction will drive the drill.

DROP FORGED OF STEEL. WORKING PARTS HARDENED.

Write for New Catalog No. 10.

**ARMSTRONG BROS. TOOL CO.,** "The Tool Holder People." **615 Austin Ave., Chicago, U.S.A.**

Makers of the Original and Complete Line of Tool Holders. All kinds. All sizes.
IMITATIONS ARE UNSATISFACTORY—INFRINGEMENTS ARE UNLAWFUL.

## MICHIGAN COLLEGE OF MINES

**F. W. McNAIR, President.**

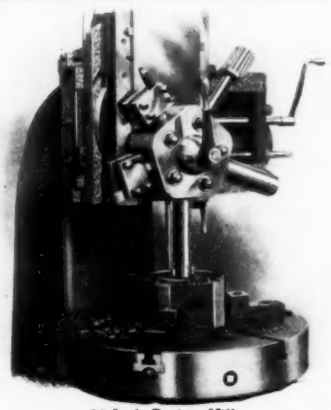
Regular summer term opens June 6th. For Year Book, giving list of graduates and their occupations, apply to President or Secretary, Houghton, Michigan.

## Worcester Polytechnic Institute.

EDMUND A. ENGLER, PH.D., LL.D., *President.*

Four-year courses of study in *Mechanical, Civil* and *Electrical Engineering;* in *Chemistry;* in *General Science. Extensive Laboratories* in Mechanical Engineering, Steam Engineering, Hydraulic Engineering, Electrical Engineering, Physics, General and Industrial Chemistry. *Well Equipped Shops* providing ample facilities for practice in Foundry work, Forge work, Machine work, Wood work, care of Engines and Boilers. Catalogue, showing positions filled by graduates, *mailed free.* Address,

J. E. MARSHALL, *Registrar,* WORCESTER, MASS.

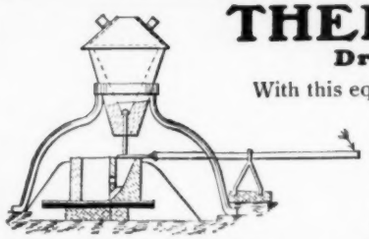


*34 Inch Boring Mill*

## Five Operations

performed on one piece without stopping the machine or changing a tool. Duplicate pieces made by the thousand. Better and faster work than any lathe can do. Send for illustrated catalog. We build all sizes from 34 to 72 in. swing.

**Colburn Machine Tool Co.**
FRANKLIN, PA., U.S.A.



## THERMIT PROCESS

**Dr. Goldschmidt Patents.**

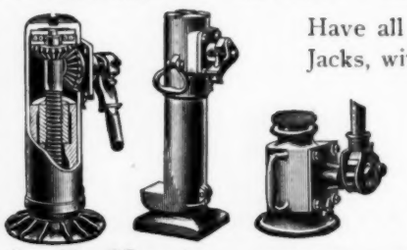
With this equipment you obtain anywhere in ½ a minute:

1. *Heat about 5400° F.*
2. *Pure Metals free from carbon,* amongst them pure steel.

You use this combination to weld iron and steel of any section, rails, girders, pipes, etc. **Titan Thermit** prevents blowholes in castings.

**Goldschmidt Thermit Co.,** 43 Exchange Place, New York.

## Norton Ball Bearing Jacks



Have all the advantages of Hydraulic Jacks, without the disadvantages.

**Guaranteed Capacity.**
**Absolute Safety.**
**Moderate Price.**

50 styles, 8 to 70 tons.

Illustrated Catalogue from the manufacturer.

**A. O. Norton, 286 Congress St., Boston, Mass.**

# NORTON EMERY, CORUNDUM AND ALUNDUM WHEELS

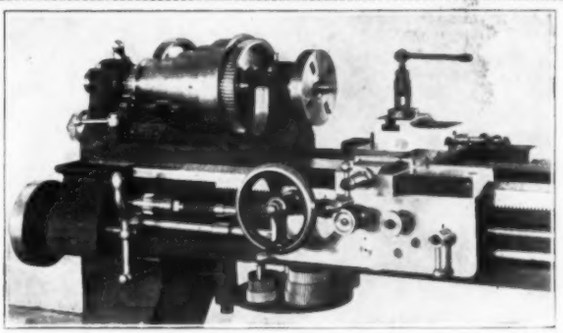
*OUR RECORDS OF EFFICIENCY CANNOT BE SURPASSED.*
*WE DUPLICATE THEM EVERY DAY IN THE YEAR IN SHOPS ALL OVER THIS COUNTRY AND THROUGHOUT THE WORLD.*

**NORTON EMERY WHEEL COMPANY,**

**Office and Works at Worcester, Mass., U.S.A.** **Chicago Store, 25 South Canal Street.**

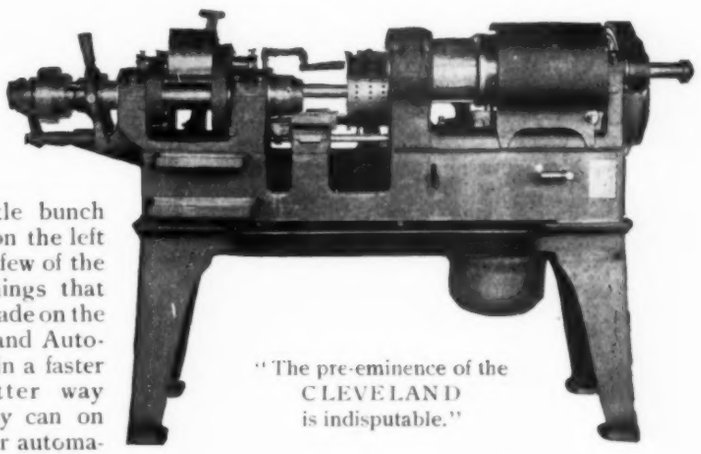
THE NEW 14-INCH
# FLATHER.

Changes of speed are secured by the simple movement of a lever. No fussing with belts or cones. Built as only Flather tools are built—to start right and stay right for years. Lathes from 13" to 30" swing. Catalog?



FLATHER & COMPANY, NASHUA, N. H., U. S. A.

## The "Cleveland Automatic"



"The pre-eminence of the CLEVELAND is indisputable."

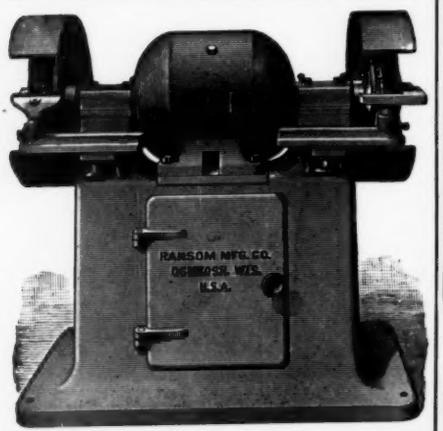
This little bunch of stuff on the left shows a few of the 1,001 things that can be made on the "Cleveland Automatic" in a faster and better way than they can on any other automatic machine made. You're bound to make money on the work put on the "Cleveland." There's no chance to lose provided you use a little sense. We'd like to have you investigate the "Cleveland," and are pleased to send descriptive matter.

**Cleveland Automatic Machine Comp'y**
**Cleveland, Ohio, U.S.A.**

EASTERN REPRESENTATIVE: J. B. Anderson, 2558 No. 30th St., Philadelphia, Pa.
CANADIAN REPRESENTATIVE: H. W. Petrie, Toronto, Ont.
FOREIGN BRANCHES: Chas. Churchill & Co., London, Manchester, Birmingham, Newcastle-on-Tyne and Glasgow. Messrs. Schuchardt & Schutte, Berlin, Vienna, Brussels, Cologne, St. Petersburg, and Stockholm. Romain Talbot, Paris.

A. G. BUTLER,
PATTERN LETTERS
E For Iron and Brass Castings Various styles and sizes. For Machines, Bridges, Tablets, etc. LEATHER FILLET. All sizes in stock. E
99 Beekman St., New York.

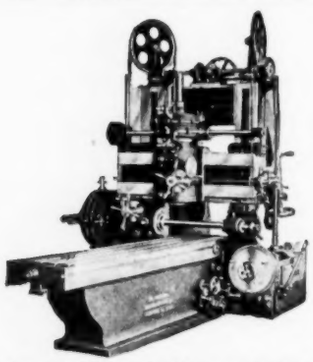
BALL BEARINGS
For All Purposes.
Auburn Ball Bearing Co.
18 COMMERCIAL STREET, ROCHESTER, N.Y., U.S.A.




MOTOR DRIVEN GRINDERS
They Save Space and Power.
Ransom Mfg. Co., OSHKOSH, WIS.

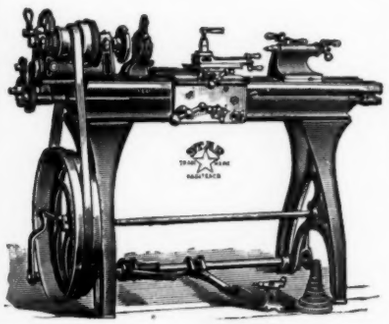
Send to Us for Prices and Details of our
Centering Machine
THE PHŒNIX MFG. CO.,
32 Union Place,
HARTFORD, CONN., U.S.A.

John A. Straley.
Louis R. Hasbrouck.
C. Augustus Dietrich.
PATENTS
AND PATENT CAUSES.
Straley, Hasbrouck & Schloeder,
COUNSELORS AT LAW,
Solicitors of American and Foreign Patents
257 Broadway, NEW YORK, N. Y.
Patents, Designs, Trade Marks, Labels and Copyrights.



Heavy Milling Machines exclusively.
Horizontal Spindle, Vertical Spindle or Four Head Machines, all sizes.
The Ingersoll Milling Machine Co.
P. O. Box 2777. ROCKFORD, ILL.

"Star" Lathes FOOT AND POWER



Suitable for machine shop and tool room service, model-makers, gunsmiths, electrical and repair shops, technical schools and colleges, for all accurate and exacting work within their capacities.

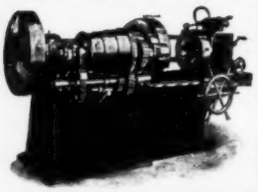
SOME IMPORTANT FEATURES

Forged crucible steel hollow spindles, phosphor bronze bearings, graduated cross feed screw, improved interchangeable plain and compound rests with graduated base, exclusive gear driven reversible cross and longitudinal feeds, and our patented spring nuts will allow quick shifts of change gears.

Ask for Complete Descriptions.

9 and 11 inch Foot Lathes.
9, 11, 12, 14 inch Power Lathes. (58)
10 and 12 inch Speed Lathes.

THE SENECA FALLS MFG. CO.,
687 Water Street, SENECA FALLS, NEW YORK, N. Y.



PIPE THREADING MACHINERY
Bolt Threaders.
Hand Stocks and Dies. Pipe Cutting-off Machines.
Pipe Couplings for Gas Lines.
Standard Engineering Works, Ellwood City, Pa., U. S. A.

DRILL VISES. Our Universal Jig Vise is a cost-cutter on drill work. Three sizes; $20, $25, $30. Circulars free.
THE GRAHAM MFG. CO., Providence, R. I.

THE PARKER VISE
Is used wherever a first-class tool is required. They are made to suit all trades and requirements and of the best material and workmanship. Our line of
MACHINISTS' VISES
is very large and complete. We also make a line of Ratchet and Boiler Drills. Send for Catalog.
THE CHAS. PARKER CO.
N. Y. Salesroom: 32 WARREN ST.
Factory: MERIDEN, CONN.

INVESTIGATE THE
Automatic Threading Lathe
FOR RAPID THREADING OF
Worms and Screws.
AUTOMATIC MACHINE CO.,
BRIDGEPORT, CT., U.S.A.

Ask for Bulletin No. 17.

THE Coates Flexible Shaft
cannot twist or untwist like a wire cable, and will revolve in either direction.
Coates Clipper Mfg. Co, Worcester, Mass

PATENTS.
FREDERICK S. STITT,
Attorney-at-Law. Registered Patent Attorney.
15 WILLIAM ST., NEW YORK.
Patents obtained in the United States and Foreign Countries. Trade Marks registered. Litigation conducted. Examinations. Opinions.

PATENTS
Trade-Marks, Labels, Copyrights, Examinations, Etc.
Questions of Validity and Infringement.
LOUIS A. HILL,
1336 New York Ave., Washington, D.C.

Reed Vises Are Right, and give satisfaction wherever used. They never slip and give a powerful grip with small effort. Details in Catalog K.
REED MANUFACTURING CO., Erie, Pa., U.S.A.

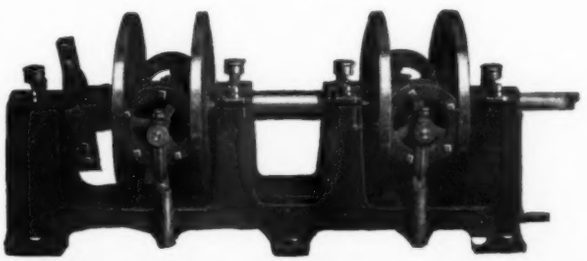
# To Still Further Increase the Economy Of Electric Driving,

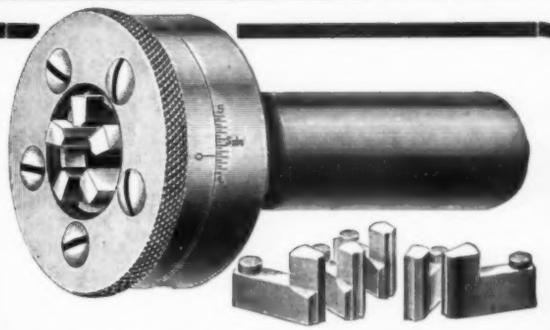
Use our Speed Controller in connection with your Alternating Current Motors running at full speed and constant load.

You can get a few changes of speed with direct current motors. but it costs a good deal and you *do not* get the fine gradations that count for so much in the production of profits, and that are so easily secured through our controller. The question of expense for such an installation fades into insignificance when compared with the savings effected through the high efficiency of this device, and its moderate first cost. May we send you our catalog?

**Power & Speed Controller Co.**

**Boston, Mass.**





**THE COST OF FINISHING BRASS GOODS IS REDUCED WITH THE ADJUSTABLE HOLLOW MILLING TOOL**

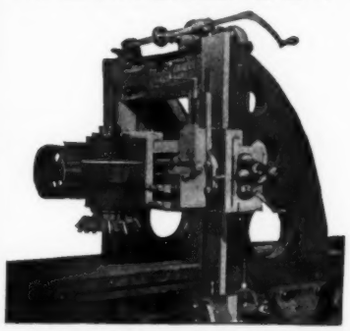
Because it gives accurate, uniform diameters at a rate it is impossible to equal by any other method.
Because it can be quickly changed from one diameter to another by the indexing device.
Because it will reduce work of any length within its capacity.
Because it will mill right up to a shoulder.
Because it is of extremely simple construction, and because the rough shop usage in no way impairs its accuracy.
You will get all details by asking for booklet.

**Geometric Drill Company,**

**Westville Station - New Haven, Conn., U.S.A.**

FOREIGN AGENTS—Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Glasgow, Newcastle-on-Tyne. Schuchardt & Schutte, Vienna, Cologne, St. Petersburg, Brussels, Stockholm, Paris.

# MILLING ON THE PLANER.



We build this miller for iron planers in four sizes. We can fit any planer. It swivels on the saddle, which provides for vertical, horizontal and angular spindle milling. Our catalog No. 55 shows many interesting samples of work done with this combination. Milling, Boring and Planing can be done at one setting of the work.

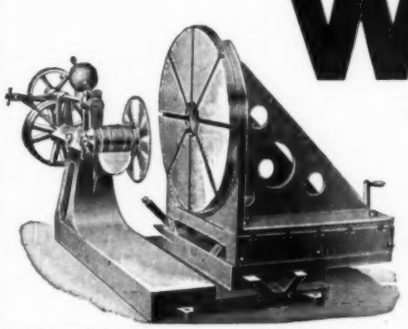
**THE ADAMS COMPANY,**

**DUBUQUE, IOWA, U.S.A.**

De Fries & Co., Dusseldorf, Germany. G. Koeppen & Co., Moscow, Russia, V. Lowener, Copenhagen, Denmark.

# WAGNER

**COLD SAWS**



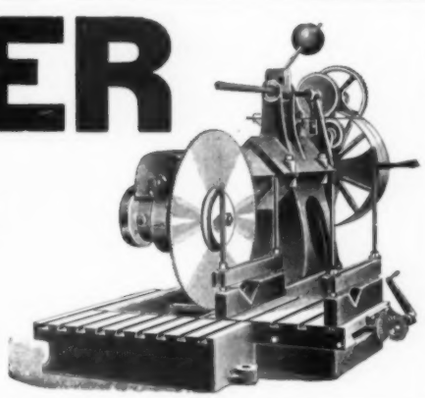
Pittsburg Office, Farmers' Bank Building.

Have swivel head—cut any angle. Built in seven sizes. Special machines built for structural shapes, crank shafts, steel castings, etc.

MANUFACTURED BY

**Diamond Drill and Machine Company,**

**Mill Street. Birdsboro, Pa.**



WHEN YOU ORDER **HORTON CHUCKS**

See to it that our TRADE MARK

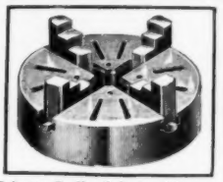
**"The Horton Lathe Chuck"**

Is stamped plainly on their face; all others are IMITATIONS.

**.... THE E. HORTON & SON CO.,**

WINDSOR LOCKS, CONN., U. S. A.

Or Chas. Churchill Co., Ltd., London, Birmingham, Manchester and Glasgow. Schuchardt & Schutte, Berlin Cologne, Vienna, Stockholm, St. Petersburg and New York. Fenwick Freres & Co., Paris, France. Van Reitschoten & Houwens, Rotterdam, Holland.



IF YOU WANT THE BEST LATHE & DRILL **CHUCKS** BUY **Westcott's** Strongest Grip, Greatest Capacity and Durability, Cheap and accurate.

WESTCOTT CHUCK CO., Oneida, N.Y., U.S.A.

Ask for catalog in English, French, Spanish or German. First prize at Columbian Exposition, 1893.

Straight **TAIL DOG**

MADE BY

**WM. G. LECOUNT,**

Successor to C. W. LeCount,

**South Norwalk, Conn.**

Send for "Catalog A." Full line of Machine Tools.

AGENTS:

CHAS. CHURCHILL & CO., Ltd., London, England

**Lever Scroll Chucks.**

A strong, heavy, serviceable chuck for general use. Well made and extremely low in price. Sizes, 6" to 18" inclusive. We are making a special discount on this line. Send for circular.

**The Cushman Chuck Co.,**

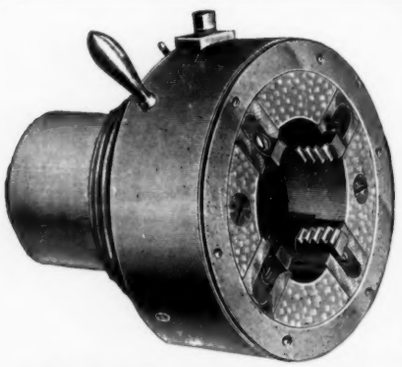
Manufacturers of All Styles of Lathe and Drill Chucks,

**Hartford, Conn.**

*The Reid Chuck*

*Was invented by a man who had used all the good chucks and knew what each one lacked. That's one reason why the "Reid" is a good chuck. Get our book.*

*R. H. BROWN & CO., New Haven, Conn.*



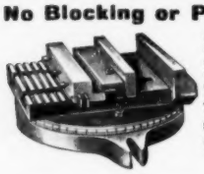
**MODERN TOOL CO.,**

Box 750, ERIE, PA.

MAKERS OF

Wallace Patent Chaser Grinders, Wallace Self-Opening Dies, Solid Adjustable Dies, Adjustable Tap and Die Holders, Hollow Milling Tools, "Modern" and "Star" Tapping Attachments, "Magic" Chucks and Special Tools.

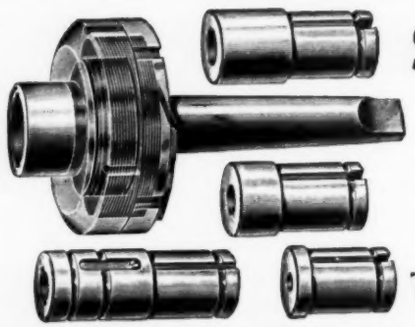
**No Blocking or Packing**



is necessary with this improved Skinner Planer Chuck. It holds either straight or taper work, and can be instantly adjusted from 0 to greatest capacity. Movable jaw will not tip back or raise work from bed. Catalog gives full details.

**The Skinner Chuck Co.**

New Britain, Conn., U. S. A.



THE

**Safety Drill & Tap Holder**

is the only attachment for the purpose that gives universal satisfaction and is

UNEQUALED FOR

**Efficiency, Convenience, Rapidity, Accuracy and Simplicity.**

Nothing to *break* or get out of *order*. Made in 4 sizes, covering from 0 to 2½ in. diameter.

**THE BEAMAN & SMITH CO.**

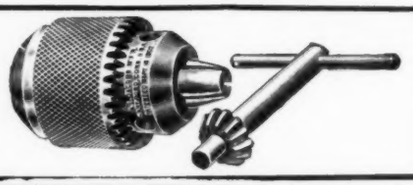
**Providence, R. I., U.S.A.**

**A BIG DEALER SAYS:**

"We have sold six times as many Jacobs Chucks as we have all the other makes combined since it was first put on the market." Don't you think this proves them to be good?

The Jacobs Manufacturing Company,

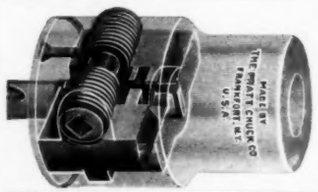
Hartford, Conn.



**The Graham Grooved Shank System Means**

a drill saving worth while. The shanks of the drill are grooved and the chuck is so made as to hold drill by these grooves so that it cannot slip, turn or draw out. We make all kinds of Twist Drills and Reamers. Book on request.

**Detroit Twist Drill Co., 230 Twenty-First St., Detroit, Mich., U.S.A.**




***The* Jaws of the Pratt Chuck Don't Do the Driving,**

They just center the drill and keep it from falling out. The driving is done in another way, and a way that makes the drive positive and the whole thing doesn't cost any more than chucks that have nothing to commend them. Book?

**Pratt Chuck Co.,** Frankfort, N. Y., U. S. A.

European Representatives: Selig, Sonnenthal & Co., 85 Q. Victoria St., London, Eng.

*Scroll Saws*

*Trump Bros. Machine Co., Mfrs.,*

*Wilmington, Del., U.S.A.*

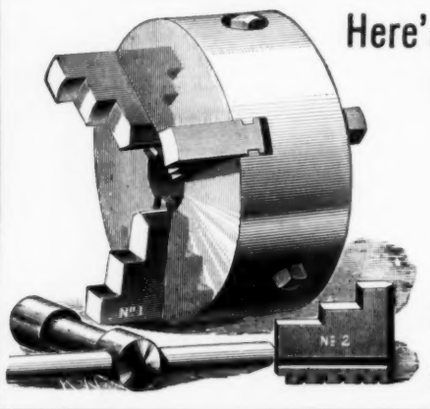
For sale by Charles Churchill & Co., Ltd., London, Eng.

**In Ordering CHUCKS The Word "SWEETLAND"**

will secure all that is desirable in a CHUCK.

**The Hoggson & Pettis Mfg. Co.,**

New Haven, Conn., U.S.A.




**Here's a Geared Scroll Chuck with a "Solid Body."**

If you know what broken chucks mean, no more need be said—this one can't break. Whiton's Chuck Book describes its good features and Whiton will be pleased to send it.

**D. E. Whiton Machine Co.**

NEW LONDON, CONN.

Sole European Agents.—Selig, Sonnenthal & Co.
Sole German Agents.—E. Sonnenthal, Jr.

**Leshure's Safety Collar** Is Loaned Free to Users of the **Hampden Wheels** HAMPDEN CORUNDUM WHEEL CO., Send for Circular. Brightwood, Mass.

# HAVE YOU SEEN

Our exhibit at the St. Louis EXPOSITION? One of our new WET DRILL GRINDERS is in operation and it will well repay you for the time spent to visit us. We are located in

**BLOCK 11, AISLE C.**

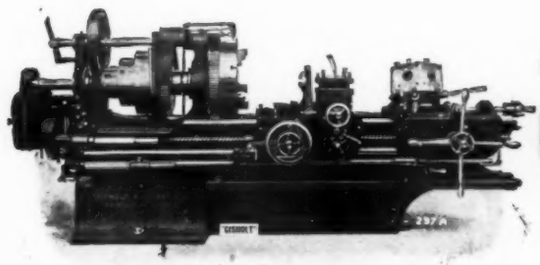
## THE WASHBURN SHOPS

OF THE

**WORCESTER POLYTECHNIC INSTITUTE,**

**Worcester, Mass, U.S.A.**

---



## Gisholt TURRET LATHES

If you are interested in reducing the cost of your lathe work, a Gisholt Turret Lathe will cut down the cost of the work of your engine lathes from ⅓ to ½ and upwards on all boring, turning and facing work.

See us at the Fair, Block 14, Aisles F and 3, Machinery Building

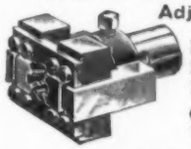
Write for Catalog G

**GISHOLT MACHINE COMPANY, Madison, Wis., U. S. A.**

1315 WASHINGTON AVENUE 516

---

# ERRINGTON OPENING DIE.



Adjustable

| | Std. | Pipe |
|---|---|---|
| No. 1 Threads to | ⅝" | ⅜" |
| No. 2 Threads to | 1" | ¾" |
| No. 3 Threads to | 1½" | 1" |

**Opens and Closes While Rotating.**

AUTO-REVERSE

# TAPPING CHUCK.

| | | |
|---|---|---|
| No. 00 | Taps to | ⅜ inch. |
| No. 0 | " " | ⅝ " |
| No. 1 | " " | ¾ " |
| No. 2 | " " | 1 " |
| No. 3 | " " | 1¼ " |
| No. 4 | " " | 1½ " |
| No. 5 | " " | 2 " |

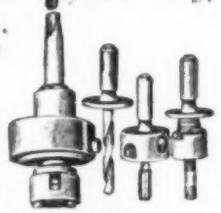
**Fits any Drill Press.**

**The Only Automatic Reverse.**

**Drills, Taps Sets Studs, In Line.**

**NO** STOPPING, REVERSING, MOVING WORK, CHANGING SPEED.

**Quick-Change Tool Holders.**



**New York Office.** 39 Cortlandt Street.

**Chicago Office,** 154 Lake Street.

England: Chas. Churchill & Co., London, Birmingham, Glasgow, Manchester, Newcastle-on-Tyne. Switzerland: American Import Machinery Office, Zurich and Chaux-de-Fonds. Germany: Arthur Kayser, Berlin, S. W., Alte Jacobstrasse 24. France: Edgar Bloxham, 17 Rue des Petites Ecuries, Paris.

---

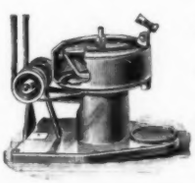
**THE TIME SAVER**

for putting on Lathes, Drilling Machines, etc. Will show exactly how far you have drilled. Instantly set to zero. Get booklet.

**Weidlog Mfg. Co.,**

7 Fulton St., Brooklyn, N. Y.

---



**COMBINED SEPARATOR AND FILTER.**

Sent on 30 days' trial. Write for prices.

**National Separator & Machine Company,**

Concord, N. H.

---

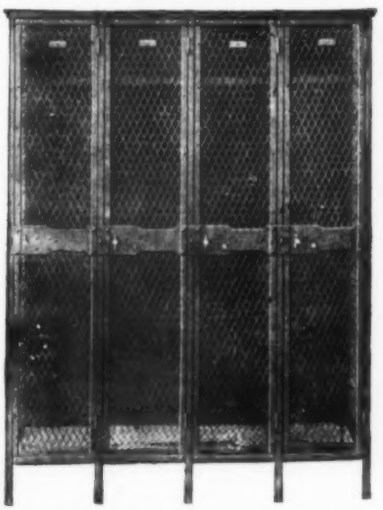
**The Vitrified Corundum Wheel Is Fast Cutting,**

because the vitrified bond is a cutting material which cannot gum or glaze. Catalog 7

**The Vitrified Wheel Co.**

Westfield, Mass.

---



# LOCKERS

OF

**EXPANDED METAL**

AND

**SHEET STEEL**

IN ALL SIZES AND TYPES.

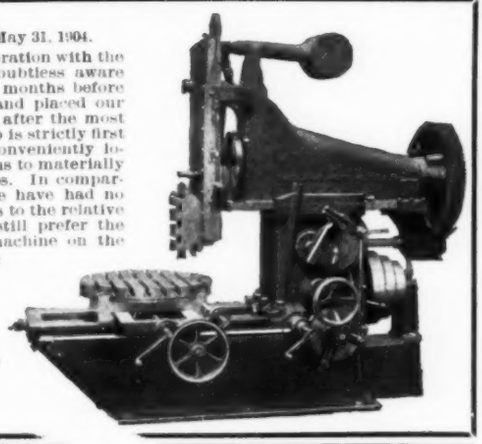
**MERRITT & CO.,**

1025 RIDGE AVE. PHILADELPHIA

---

"We have two of these machines in operation with the most satisfactory results. You are doubtless aware that we used one machine six or eight months before placing our order for the second one, and placed our order for the second Dill Machine only after the most careful investigation. The workmanship is strictly first class, and the operating mechanism conveniently located, and we find the machine enables us to materially lessen the cost of production in our shops. In comparing the machine with other makes we have had no reason to change our original opinion as to the relative value of the different machines, and still prefer the Dill Slotter to any other make of machine on the market."

PAWLING & HARNISCHFEGER.



The Dill Slotter Peo[illegible]

Philadelphia, Pa.

---

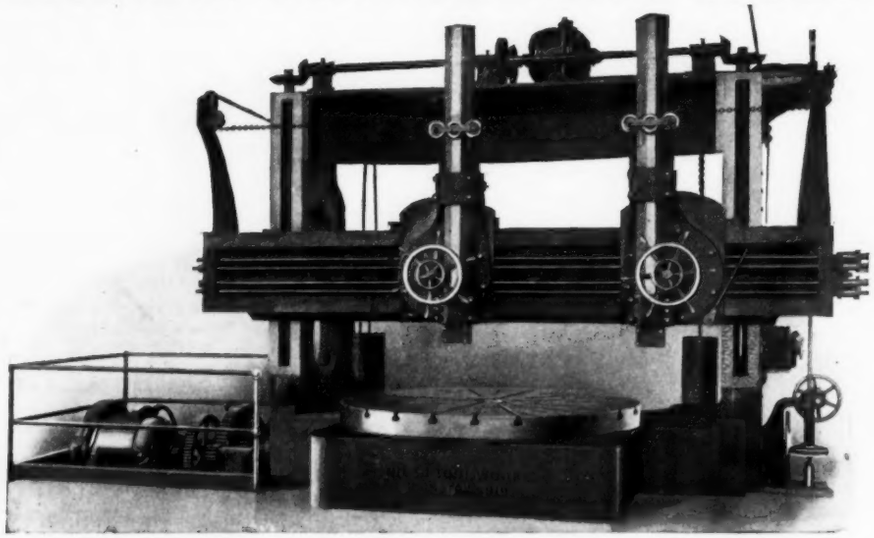
LEATHER (PAT. NOV. 14, 1893) AND OBTUSE WOOD **FILLET** For Patterns is made correct in shape and in price we compete, in quality we excel.

**ALL STEEL CEMENT** For filling blow holes in castings. The best of good things. Write for sample.

THE CANTON FILLET CO., MAKERS SINCE 1893, CANTON, OHIO, U.S.A.

# General Electric Company

## MOTORS FOR MACHINE TOOLS.



General Electric C. E. 10 H. P.—800 R. P. M.—500 Volt Motor geared to Bed Plate and General Electric C. E. 5 H. P.—1,200 R. P. M. Motor Direct Connected to Cross Head of a 12 foot Niles Boring Mill.

**PRINCIPAL OFFICE, SCHENECTADY, N. Y.**

**New York Office, 44 Broad Street.** **Sales Offices in All Large Cities.**

FOR GREAT BRITAIN AND IRELAND: The British Thomson-Houston Company, Rugby and 83 Cannon Street, London, E. C.

**OUR NEW LINE OF**

# Type "S" Constant or Variable Speed Motors

**Are Sold Under the Following**

## BROAD GUARANTEES:

**(The strongest ever made.)**

Open Floor Style.

Enclosed Floor Style.

If the machines are properly installed, adjusted and operated, we guarantee, for the open-type machines at our standard ratings, that:

(1) After a continuous run of twenty-four hours at full load, no part will show a temperature rise of over 30° C., or 54° F., above temperature of surrounding air, by thermometer.

(2) After a continuous run of twelve hours at full load, followed by a run of two hours at 25 per cent. overload, no part will show a temperature rise of over 35° C., or 63° F., above temperature of surrounding air, by thermometer.

(3) The machines will not spark at any load up to 50 per cent. overload.

(4) They will stand overloads of 50 per cent. for two hours, or 100 per cent. for one-half hour without injury.

(5) They will run without objectionable noise or vibration.

(6) No brush movement will be necessary between full load and 50 per cent. overload.

**Our Bulletin 151M telling all about them, is free for the asking.**

Open Wall Style.

## The C & C Electric Company

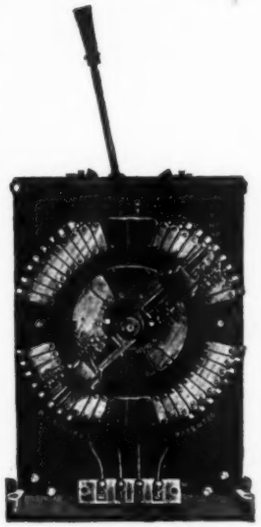
**143 Liberty St., New York.**

Works: Garwood, N. J.

Branches: 45 N. Seventh St., Philadelphia. 652 Monadnock Block, Chicago. 176 Federal Street, Boston.

Open Ceiling Style.

## Dinkey Ventilated Controllers



Are undeniably the best Controllers for severe service. Easily accessible — self-contained—all parts interchangeable. Send for Catalogs.

*Look for us in the Palace of Electricity at the World's Fair.*

**The Electric Controller & Supply Co.**

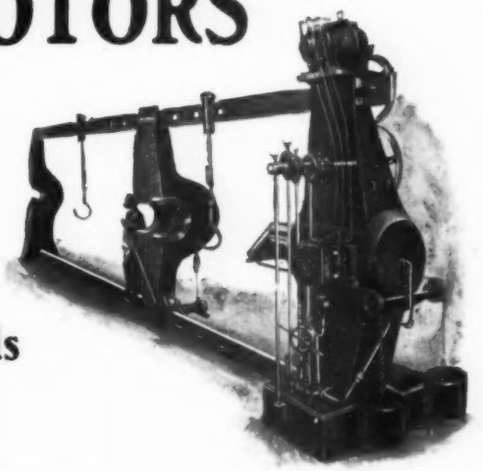
Manufacturers and Consulting Electrical Engineers,

Main Office, Cleveland, Ohio.

515 Frick Bldg., Pittsburg, Pa. 136 Liberty Street, New York. 47 Victoria Street, London, Eng.

## MOTORS

**For All Kinds Of**



**MACHINE TOOL DRIVING**

Acknowledged to be the leaders in their class. Write for descriptive bulletin No. 21913.

**SPRAGUE**

**ELECTRIC COMPANY**

GENERAL OFFICES

527 WEST 34TH STREET, NEW YORK

## "The Machine Tool Motor"

We manufacture it for any output from 3 to 45 h.p. and are engineers for its efficient application to machine tools.

*Write to us for recommendations.*

**Crocker-Wheeler Company**

Manufacturers of Generators and Motors.

**Ampere, N. J.**

Branch Offices in Sixteen Principal Cities.

89

? What would you think of paying your men half to three-quarter time when they are not working?

Yet you thoughtlessly give your machinery one-half to three-quarters of its normal load power requirements—give it to line shafting—a tribute to friction! !

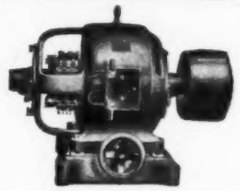
Let us acquaint you with Northern Methods of putting your machinery on a paying basis—giving it nothing without adequate returns.

Bulletin No. 291 tells about the motor which figures in our plans for profitable shop methods.

**Northern Electrical Mfg. Co.**

Engineers, Manufacturers, Madison, Wis., U.S.A.

JANTZ & LEIST ELECTRIC CO.
MANUFACTURERS OF HIGH-GRADE
MULTIPOLAR MOTORS AND DYNAMOS.
Standard sizes from 3 to 100 K. W., 110, 220 and 500 Volts.
*Motors for direct connection to all kinds of machinery.*
SPECIAL DYNAMOS FOR ELECTROTYPERS AND PLATERS.
[From 1 to 6 Volts and from 400 to 5,000 Amperes.]
N. E. Corner Andrews and Elm Sts., CINCINNATI, OHIO, U.S.A.



You can save
from 40 to 65 per cent. of your power by using
**Triumph Motors**
to drive your machine tools. This is the per cent. of power consumed in many shops by line shafts and long belts.
All this can be saved by gearing or belting our motors directly to the machines.

Four Spindle Drill, driven by Triumph Motor.

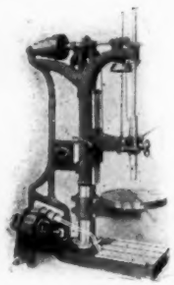
*Ask for Bulletin "AM 201"*

**Triumph Electric Company**
Cincinnati, Ohio, U.S.A.
Branches in all large cities.

**The Standard Motors at the Fair**

We have placed a large and well assorted stock of these motors in the hands of the E. C. Van Nort Electric Co., at 12 North Eighth St., St. Louis.
Exhibitors needing Motors will be able to find whatever they may require in this line under 15 H. P. in this stock.

**The Robbins & Myers Company,**
**Main Office and Works, Springfield, Ohio.**
New York Office, 170 Broadway.



There is a **correct** way of doing everything.

*Bulletin 134*

**Commercial Electric Co.,**
Indianapolis, Ind., U.S.A.

*We have a Special Proposition to make on*

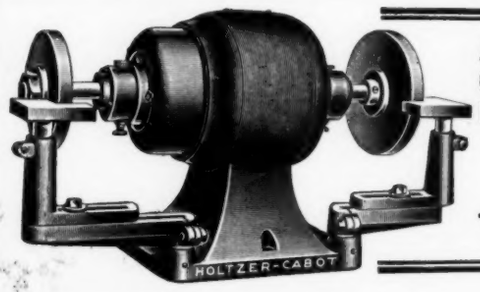
*KEYSTONE MOTORS*

*TO*

*Machine Tool Builders.*

*Send for Catalog.*

*The Keystone Electric Co.,*
*ERIE, PENNA.*




**An Electric Grinding and Buffing Machine.**

Dust proof. Fitted with chucks for either Buffing or Grinding. Adjustable Tool Rests. Prices and details on application.

**The Holtzer-Cabot Elec. Co.,**
Boston (Brookline), Mass.

**Pipe Threading Machines.**
NEW DESIGNS JUST COMPLETED
WITH MANY IMPROVEMENTS
**The Stoever Foundry & Mfg. Co.,**
MYERSTOWN, PA.

**PERFECT**
**Leather Fillet**
Pat. Nov. 14, 1893.
*Constructed with curved sides* geometrically correct.
Conforms easily to *all kinds* of curves and corners.
Forms a perfect arc of a circle when applied.
PATTERN LETTERS, DOWELS, RAPPING PLATES, ETC.
*Immediate shipments. All* material guaranteed *satisfactory.*
**The Beskin Mfg. Co., Canton, O., U.S.A.**
Established 1892.

REG. TRADE MARKS
"Phosphor Bronze"
DELTA

THE PHOSPHOR BRONZE SMELTING CO. LIMITED.
2200 WASHINGTON AVE., PHILADELPHIA.
"ELEPHANT BRAND PHOSPHOR-BRONZE"
INGOTS, CASTINGS, WIRE, RODS, SHEETS, ETC.
— DELTA METAL —
CASTINGS, STAMPINGS AND FORGINGS
ORIGINAL AND SOLE MAKERS IN THE U.S.

**Pattern and Model Work of Every Kind**
Manufactured to your own specification, in a prompt manner.
We guarantee all work, and furnish estimates.
**Penn Pattern and Model Works, 1427 Catharine St., Phila., Pa.**

## Steam Engines, Paper Machinery and Printing Presses
**BUILT TO ORDER**

SPECIAL MACHINERY DESIGNED AND BUILT ALSO. SEND SPECIFICATIONS.

**Taunton Locomotive Manufacturing Co., TAUNTON, MASS.**

## You Can Search

the world over without finding its equal as a universal pocket measure. Is an adding machine for estimators, gives the cutting speeds within the fraction of an inch. Measures curved work, spirals and the like as easily and positively as straight work, and measures them *quickly* and *accurately*. Its simplicity is surprising. Circular?

**Steckenreiter Mfg. Co., 536 W. 58th St., New York, N.Y.**

Blue Prints are made at minimum cost on

## Patent Cylindrical Electric Copier.

Write for Catalog.

**Pittsburg Blue Print Co.,**
1505 H, Park Building, Pittsburg, Pa.

## What Salary Do You "Draw"?

Are you improving in your drawing, or are you falling off? Before you can increase your salary you must increase your efficiency. The

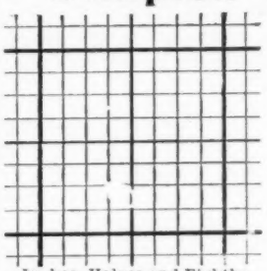
**Rich Handy Drawing Outfit**

will help you to be a better draughtsman, because its use insures accuracy. It doesn't cost much.

Write for circular telling all about it.

**J. & G. RICH,**
120 N. Sixth St., Man'f'rs.
Philadelphia, Pa., U.S.A.

## Simplex Cross-Section Paper.



Inches, Halves and Eighths.

A new article of great utility. Our well-known **Simplex Detail Paper**, 8 x 8 to the inch, in continuous rolls, **engraving 30 inches wide.** Labor saving! Time saving! Low in price! Sample sent on application.

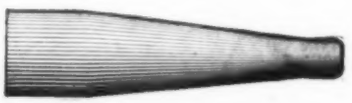
**KEUFFEL & ESSER CO.,**
**New York, - 127 Fulton St.**

Branches: Chicago, 111 Madison St. St. Louis, 708 Locust St. San Francisco, 303 Montgomery St.

**Drawing Materials, Surveying Instruments, Measuring Tapes.**

Catalogue (500 pp.) sent free on application.

## For Swaging Tubes and Shells



The Dayton Swaging Machine stands first, inasmuch as such work is handled fast and is always right when finished. It will afford us much pleasure to send you a Treatise on Swaging, which goes into the matter very thoroughly.

**Excelsior Needle Company,**
**Torrington, Conn.**

Coventry Swaging Co., Ltd., White Friars Lane, Coventry, England, Agents for Great Britain. Fenwick Freres & Co., 21 Rue Martel, Paris, France, Agents for France, Italy, Belgium, Spain, Portugal and Switzerland.

# STARRETT TOOLS

**Are the STANDARD for ACCURACY, DESIGN, WORKMANSHIP, and FINISH.**

**They EMBODY the BEST and MOST ADVANCED IDEAS in PRACTICAL TOOL-MAKING.**

## The Acme of Rule Perfection.

Spring Tempered Rules with heavy figures, graduated end and beveled edge. Made in 2, 3, 4, 6, 9, 12, 18 and 24 inch sizes.

No. 403, No. 4 grad., with 64th's on the beveled edge, and graduated in 32d's on opposite sides of one end.

No. 404, No. 4 grad., with 64th's on the beveled edge, and graduated in 32d's on one side and 48th's on the other side of the same end.

These rules are the most advanced product of the rule maker's art. They are sold at the same prices as ordinary spring tempered rules.

Send for Free Catalogue No. 17C of Up-to-Date Tools for Mechanics.

**THE L. S. STARRETT CO., Athol, Mass., U.S.A.** NEW YORK STORE, 123 Liberty St. CHICAGO STORE, 15 So. Canal St.

FOREIGN AGENTS—Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Glasgow. Schuchardt & Schutte, Berlin, Cologne, Brussels, Stockholm, Vienna, St. Petersburg, Paris, Milan, Liege, Bilbao. Adler & Eisenschitz, Milan. W. Hummel hls, La Chaux de Fonds. Wilh. Sonnesson & Co., Malmo, Copenhagen. Acktiebolaget B. A. Hjorth & Co., Stockholm. V. Lowener, Copenhagen. Ignacz Szekely, Budapest. Thos. Drysdale & Co., Buenos Ayres. Edge & Edge, Sydney, Melbourne. F. W. Horne, Yokohama.

J. H. BARCLAY, PRESIDENT
A. P. WARNER, VICE PRES. & MANAGER
C. H. WARNER, SECY. & TREAS.

Warner Instrument Company

MANUFACTURERS OF
CUT-METERS TACHOMETERS
AND
AUTOMOBILE INDICATORS

BELOIT, WIS June 10/04.

American Machinist,

World Bldg., New York City.

Gentlemen:-

We have your letter of June 7th and note that you have allowed us the front page of your issue of Feb. 17th. We presume that we are like all the rest of your advertisers as we should like the front page of the first issue of the month, and at a little more busy time of the year then February but if this is the very best you can do for us, we will have to accept the same with thanks.

While we are on this subject, we wish to thank you for the results you have obtained for us through our advertising in your paper. We think we have had an exceptionally good opportunity to judge of the merits of the different technical papers, as we started in with an entirely new device, which had never been advertised before, and with the intention of determining which was the best paper for our use. In this competition, the American Machinist has far out stripped its closest competitor on the basis of money spent in each paper. In fact we have received more replies and orders from the American Machinist, than all of the other papers put together, and we have received more foreign orders through our advertising in your paper, than the combined orders, foreign and domestic of any other paper.

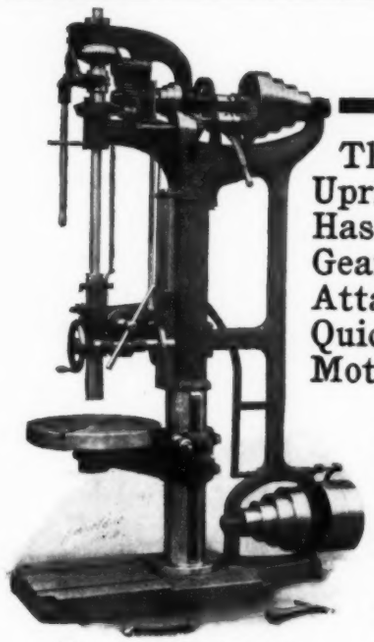
The only thing now lacking to make our happiness complete, would be the front page of the American Machinist for an issue of the first of the month, preferably, April or June.

Yours very truly,

Dict. A. P. W.

WARNER INSTRUMENT CO.,
Per A P Warner

☞ AMERICAN MACHINIST advertising "makes good."



## The Cincinnati Upright Drill Has a Patent Geared Tapping Attachment and Quick Return Motion

fixed directly on the spindle. Another important feature is the strongly ribbed and braced base, also the unusually large diameter column; these give the machine such extreme rigidity that high speeds and heavy feeds can safely be used without interfering with the accuracy of the output.

This name plate THE CINCINNATI guarantees the best quality.

*Details in catalog. Ask for it.*

**Cincinnati Machine Tool Co.,**

Western Ave. and Dayton St., CINCINNATI, O., U.S.A.

AGENTS—Buck & Hickman, Ltd., Agents for Great Britain; R. S. Stokvis & Zonen, Agents for Holland and Dutch East Indies. Canadian Agents—H. W. Petrie, Toronto, and Williams & Wilson, Montreal.

## Superior to All Others

Is the candid opinion of all users of the

## Burt Exhaust Head

"We believe the Burt Exhaust Head to be the best on the market"—*The Peerless Electric Co., Warren, Ohio.*

Order to-day, giving size of pipe, and test the merits of the Burt Exhaust Head. If unsatisfactory, return.

**The Burt Manufacturing Co.**

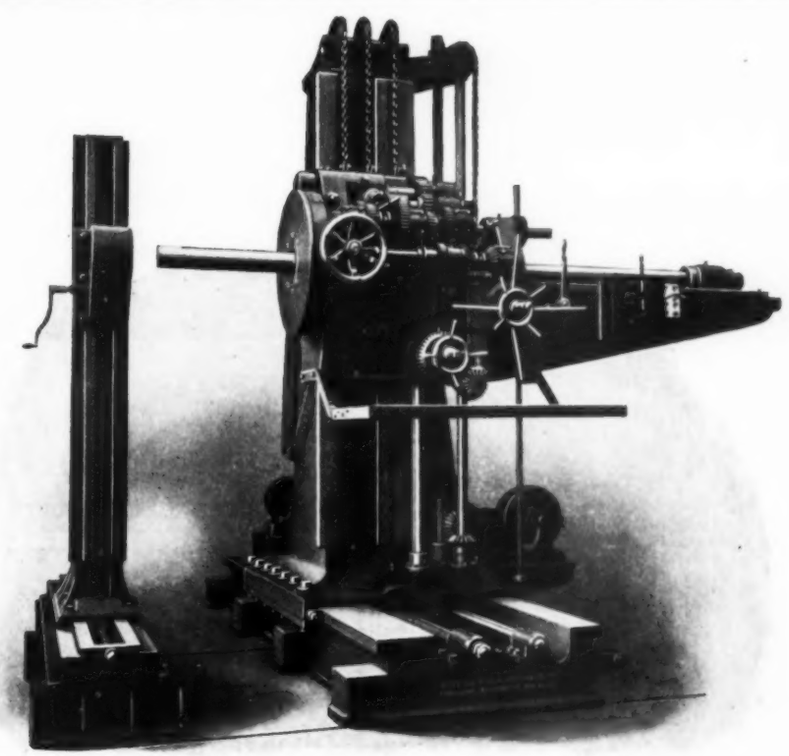
The Largest Manufacturers of Oil Filters in the World.

255 Main St., Akron, Ohio, U.S.A.

Also Supplied by Engine Builders, Dealers, and Power Contractors.

80

# 72-Inch Horizontal Boring, Drilling and Milling Machine.



**Also made in 40 in. and 60 in. sizes.::::**

## The Detrick & Harvey Machine Co., Baltimore, Md.

MAKERS OF THE OPEN SIDE IRON PLANERS.

**Iroquois Machine Co.**

MANUFACTURE UNDER PATENTS
Improved Universal, Plain, Disc, Face, Surface
**GRINDING MACHINES,**
Wire Drawing Machinery,
Office 150 Nassau Street, NEW YORK, U.S.A.

**Small Steel Castings**
Of Graphitic Steel.
**Open Hearth Steel Castings**
**Gray & Malleable Iron Castings**

QUICK DELIVERIES

**West End Manufacturing Co.,**
14 Church St., New York.

**Improved Capital High Speed STEEL**
The Best, Most Durable, Easiest to Work.
EDGAR T. WARD & SONS, 23-25 Purchase St., Boston, Mass., U.S.A.

AIR-HARDENING
TRADE MARK GRANTED 1898.
**EDWIN R. KENT & CO.,**
10 SO. CANAL STREET, CHICAGO.
**Edgar Allen's High Speed Steel**
For lathe and planer tools, saves time and labor, combines a toughness with the requisite hardness so that very heavy cuts may be taken.
Branch Office—51 John Street, New York.

will turn off blue chips on any kind of work.

**Firth-Sterling Steel Co.**

Pittsburgh, New York,
Chicago, Boston,
Philadelphia.

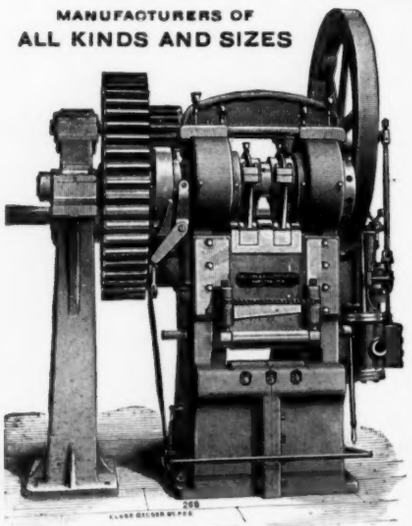
**DIAMOND TOOLS**
OF ALL KINDS
For Turning Hard Rubber and Carbon.
Emery Wheel Dressers
**The Steel Set Diamond Co.**
36 Gold Street, New York.

**McGeorge & Sons,**
Consulting Engineers,
Citizens Bldg., Cleveland, O.

**Heavy Iron Castings,** Machine Molded Gears, Pattern Molded Gears and Semi Steel Castings.
**Farrel Fdy. & Mach. Co.,** Ansonia, Conn.

**A Little More Knowledge**
on a much-discussed subject. A new booklet entitled
**"SLIPPING BELTS**
**Conditions, Causes and Cures,"**
will be sent upon request to all interested in leather belting.
JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.
Please Mention this Paper.

THE LONG and ALLSTATTER CO.
MANUFACTURERS OF
ALL KINDS AND SIZES



BILLET SHEAR—STEAM DRIVEN.
...POWER...
**PUNCHES and SHEARS**
HAMILTON, OHIO, U. S. A.

**Open Hearth Steel Castings**
Steel Castings of every description, small and large, complicated and cored work.
Main Office:
152-154 W. 34th St., New York.
Foundry: Delawanna, N. J.
THE COOPER-WIGAND-COOKE CO.

Are you having some
TROUBLE WITH A DIE?
We can furnish you
**DIE FORGINGS**
that will cut from
100% TO 200% MORE BLANKS
from Sheet Metal than you ever cut before.
IT PAYS TO USE THE BEST.
**Crucible Steel Forge Co.,**
CLEVELAND, OHIO.
SEND SAMPLE. WRITE US.

**A CLEVER MAN**
USES OUR
**GRINDSTONES**
FOR GRINDING CASTINGS AND 1000 OTHER THINGS BESIDES EDGE TOOLS
SEND TO DAY FOR NEW CATALOG.
THE CLEVELAND STONE COMPANY
EUCLID AV. CLEVELAND OHIO.

IF YOU WANT VERY GOOD CRANES GET NORTHERN.

# CRANES

Electric and Hand—Send for Catalog No. 15—Free. Overhead Electric Traveling Trolley Hoists and Tracks.

NORTHERN ENGINEERING WORKS, EAST ATWATER ST., DETROIT, MICH.

**No Kink To This Chain—It's a "Triumph."**

This chain is so constructed that the wear is distributed on two points, instead of on one as with welded chains. It's light, strong and low in price. 14 sizes. Made in steel, brass, bronze, or aluminum. Write for circulars.

BRIDGEPORT CHAIN CO., BRIDGEPORT, CONN.

CLEVELAND CRANE AND CAR CO.

WICKLIFFE, O.

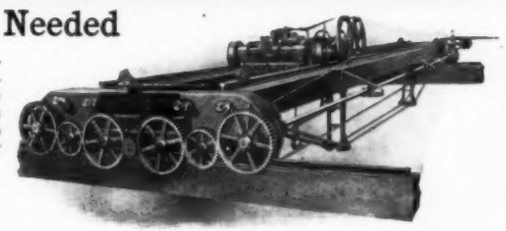
NEW YORK OFFICE SINGER BL'D'G.

CHICAGO — PITTSBURG

S OF ALL KINDS FOR ALL PURPOSES

## A Signal Man Isn't Needed

With our Power Traveling Crane because the operator's seat is located directly over the hook and he can see to place the load himself with both ease and accuracy. These cranes are cheap enough for everyone. Send for our catalog and learn about them.



**Lane Manufacturing Co.**

Montpelier, Vt., U. S. A.

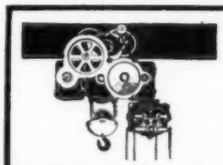
FERROINCLAVE

**Fireproof Roofing for Machine Shops.**

Write for Ferroinclave circular.

*The* **BROWN HOISTING MACHINERY CO.,**

**New York. Cleveland. Pittsburg.**



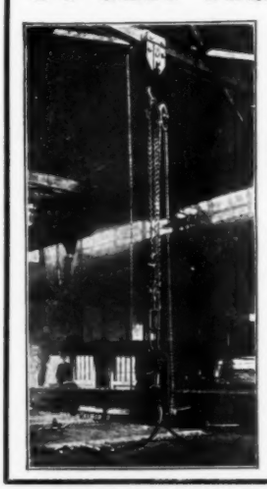
**Traveling Electric Hoists.**

Cut shows type for capacity of 2 tons and under. Photos and data on request.

PAWLING & HARNISCHFEGER,

160 Clinton St., MILWAUKEE, WIS.

## 30 DAYS' FREE TRIAL



of the "Triplex" Block will more than convince you that it will do your hoisting at twice the speed and with half the effort of the best of other blocks. Ask for one now. Get catalog too.

*See our exhibit, Block 29, Machinery Hall, World's Fair.*

**Yale & Towne Mfg Co.**

9-11-13 Murray St., New York, U.S.A.

European Warehouses: Fairbanks Co., London, Eng. Fenwick Freres & Co., Paris, France

AMERICAN PIONEER

TRADE MARK

PRESSED STEEL SHAFT HANGER

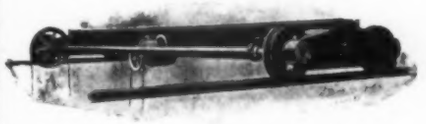
STANDARD PRESSED STEEL CO.,

20th and Clearfield Sts., PHILADELPHIA, PA.

# THE CURTIS

**Single I Beam**

# CRANE.



**Pneumatic Elevators**

**Geared and Direct Acting.**

**Curtis & Co. Mfg. Company, St. Louis.**

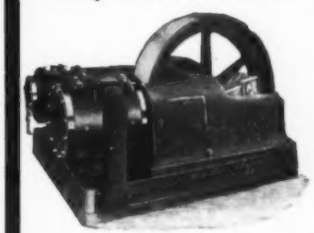
Walter H. Foster, New York. Hill, Clarke & Co., Boston. Baird Machinery Co., Pittsburg. Strong, Carlisle & Hammond, Cleveland.

REEVES VARIABLE SPEED TRANSMISSION

will give you the correct speed and save time. Details in catalog. Get it.

**Reeves Pulley Co., Columbus, Ind.**

THE BLAISDELL AIR COMPRESSORS.



Send for Bulletin 12

Every Type for Every Service.

**The Blaisdell Mach'y Co.,**

BRADFORD, PA.

1532 Monadnock, Chicago. 818 Witherspoon Bldg., Philadelphia.

39 to 835 cubic feet of free air per minute is the range of capacities of our

**Air Compressors**

when belt driven. They are, however, suitable for steam and electrical drive where desired. Book free.

**Herron & Bury Mfg. Co.,**

Erie, Pa., U. S. A.

Philadelphia—935 Drexel Building. New York—120 Liberty Street. Paris—Fenwick, Freres & Co. London—J.W. Jackman & Co.

BOLT CUTTERS.

Reliance are the kind that adjust quickly and stay adjusted, cut perfect threads, and never force the dies onto the threaded bolts to release them. Write for details.

Reliance Machine and Tool Co.

CLEVELAND, OHIO, U.S.A.

**TRAVELING CRANES**

JIB

THE **Case Manufacturing Co.**

COLUMBUS, OHIO.

**POWER TRANSMISSION APPLIANCES.**

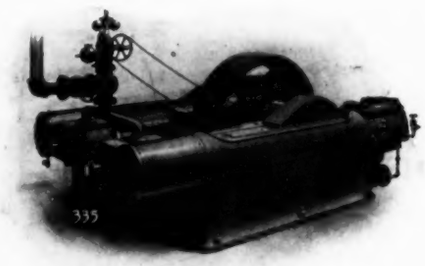
COM-PRESSORS PNEUMATIC TOOLS ROCK DRILLS

## Soo River

is going to be dredged—that is, the Nebish channel is to be deepened and widened.

¶ Two miles long—
Twenty-five feet deep—
Three hundred wide—

¶ Of course there will be a big central air plant.




¶ This tremendous undertaking will only take four years to complete—possib'y less.

¶ Rand Compressors will furnish the compressed air.

¶ Twenty-five Little Giants will be operated by the machines, besides several pumps and cableways.

¶ We sell small compressors too—just as good for small work as our big ones are for big jobs.

Send for Miniature Compressor Catalog.
Dept. 1.

RAND DRILL Co. 128 BROADWAY N.Y.

# Fast Work

With most tools men work slowly because it is easier. Working fast usually means working hard. But with

KELLER PNEUMATIC TOOLS

it is easier to work fast than to work slowly. It's like trying to make a spirited horse walk, when he wants to make speed. Keller Tools will do the work, if you will only let them. All the driver has to do is to guide them, and let them go.

Write for our new catalogue and booklet on the "Care and Use of Pneumatic Tools."

PHILADELPHIA PNEUMATIC TOOL CO.
21ST ST. & ALLEGHENY AVE.,
PHILADELPHIA.
NEW YORK CHICAGO PITTSBURGH
S. N FRANCISCO BOSTON

Something New, A Catalog Entitled

# "LABOR SAVING TOOLS OPERATED BY COMPRESSED AIR"

**No. 5**

**Just Issued by**

# THE INGERSOLL-SERGEANT DRILL CO.

**Chicago, Ill.**
**Cleveland, O.**
**St. Louis, Mo.**

**26 Cortlandt Street, New York.**

**Boston, Mass.**
**Pittsburg, Pa.**
**Philadelphia, Pa.**

A 6

From the time the Cleveland Riveters and Chippers were first put on the market **they have been made the standard for comparison.**

Why buy something "just as good" as the "Cleveland"? If you buy "Clevelands" you get that which was **originally the best,** and they are the **best to-day.** In use throughout the civilized world. We have built up a large foreign trade, yet we have never sent a representative across the water. **MERIT did it.**

**THE CLEVELAND PNEUMATIC TOOL CO.,**
**CLEVELAND, O., U. S. A.**

John Turnbull, Jr. & Sons, Glasgow, Scotland. Pressluft-Gesellschaft m. b. H., Dusseldorf, Germany.

# AIR COMPRESSORS

FOR ANY VOLUME AND FOR ANY PRESSURE.

WRITE FOR CATALOG No. 22.

N. A. CHRISTENSEN, 1212-17 Herman Building. MILWAUKEE.

# DISK GRINDERS.

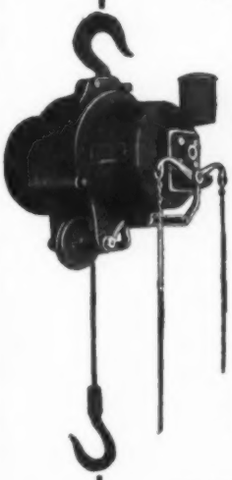
**R. W. NEY,**
**PINE PLAINS, - N. Y.**

AIR COMPRESSORS
ENCLOSED SELF OILING
DUST PROOF
THE BLANCHARD MACHINE CO.
BOSTON, MASS.

# ½ Ton.

**Have you any light loads to get up**

**Quick?**



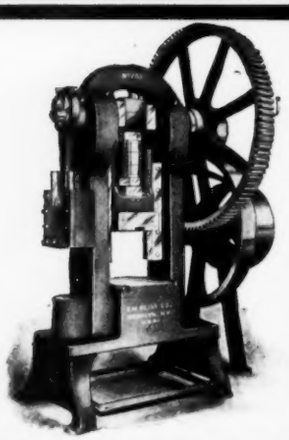
**Try Our**

**No. 0 Hoist.**

BULLETIN No. 82.

The General Pneumatic Tool Co.,

Montour Falls, N. Y.



"Bliss" No. 75½ Trimming Press Geared.

# E. W. BLISS CO.,

**1 ADAMS STREET, BROOKLYN, N.Y., U.S.A.**

OWNERS OF

Stiles & Parker Press Co., U. S. Projectile Co., Orr & Hess Machine Co.

EUROPEAN OFFICE:—4 Rue Huntziger, Clichy pres Paris, France.

BUILDERS AND DESIGNERS OF

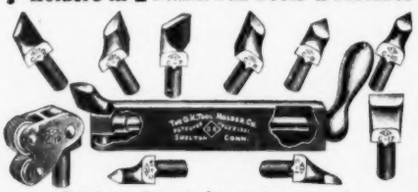
**Presses, Dies, Drop Hammers, Double Seamers, Shears and Special Machinery.**

**Cast Iron and Steel Cut Gears and Pinions.**

**Seamless Steel Forgings, such as Bottles, Bowls, Collars, Cylinders, etc.**

Distributing Agents for Chicago and vicinity:—Stiles-Morse Co., 65 W. Washington St., Chicago, Ill.

**7 Holders in 1** with an assortment of **22 Tools & Fixtures**



Catalog and particulars sent on request.

**O. K. Tool Holder Co.,** Shelton, Conn., U. S. A.

# DROP PRESSES

**For All Purposes Our Specialty.**

**MINER & PECK MFG. CO., Proprietors of**

THE PECK DROP PRESS WORKS, - NEW HAVEN, CONN.

**Save Time** in Chucking,

**Save T Slots** in your machines,

**Save Worry** looking for bolts,

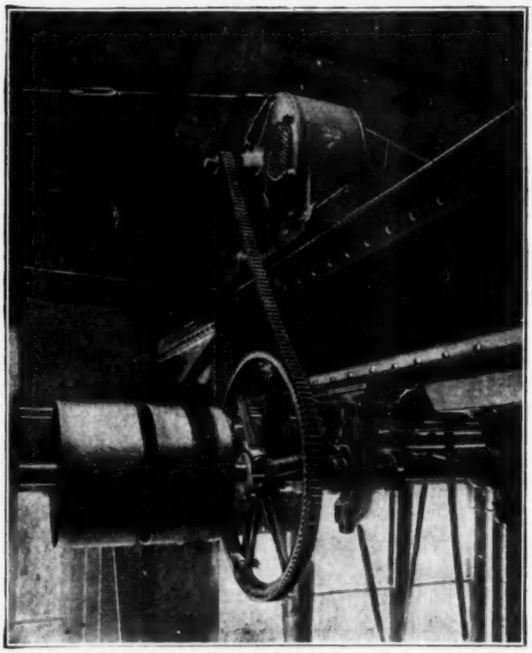
USE

**Lang's T Bolt Heads.**

**G. R. LANG COMPANY,**

CINCINNATI, OHIO.

The E. A. Kinsey Co., Cincinnati, O., General Agents.



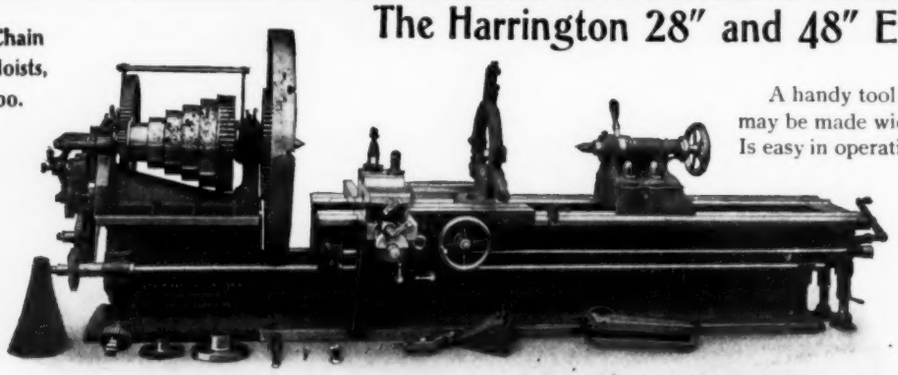
## The Morse Flexible Gearing

Is a transmission for light or heavy duty, fast or slow. It is noiseless, frictionless, has no slack to be taken up, needs but little, if any, lubrication and will operate anywhere and everywhere, and especially where conditions make the use of belts undesirable. An example of this transmission is here shown. Motor R. P. M. 1,200, chain speed 1,170 ft. per min., pull 425 lbs. Catalog describes in detail.

**Morse Chain Co.,**
Trumansburg, New York.

**Chain Hoists, too.**

## The Harrington 28" and 48" Extension Gap Lathe.



A handy tool for repair or jobbing shops. Gap may be made wide or narrow to suit width of work. Is easy in operation and covers a very wide range of work. Is a lathe of the utmost lathe conveniences. It should have your careful attention.

**Edwin Harrington, Son & Company, Inc.,**

Philadelphia, Pa., U. S. A.

**Greenerd Arbor or Mandrel Presses** for driving arbors (mandrels), bushings and pins. A general utility tool. Saves time, saves finished work and prevents springing and battering. Catalogue giving full details sent on request, or will be glad to send a press on 30 days' trial.

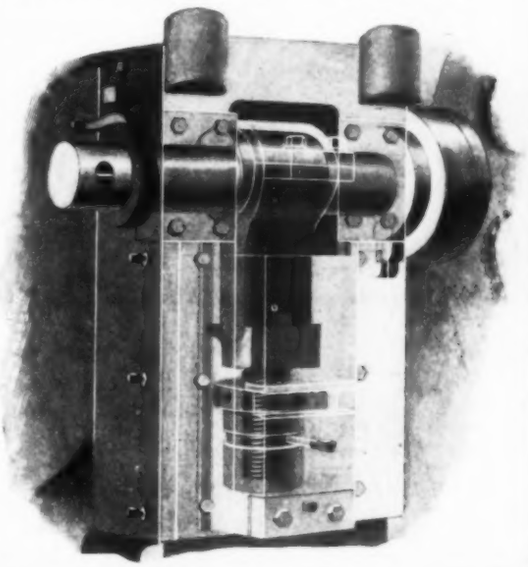
**E. E. BARTLETT,**
362 ATLANTIC AVE., BOSTON, U.S.A.

No. 5 Model A Press.
Weight, 1800 lbs.
Blanking Capacity, 8" x ⅛" Machinery Steel.
Built in 9 Sizes, Plain or Geared.

# The Big Overload Will Not Harm A Perkins Press, Because The Belt Will Slip Off

and the press stop. Perkins Presses are built this way. They have a large diameter shaft with solid eccentric. The bearings are part of the frame and reach close to the eccentric. There is a steel pitman, screw and nut, and the nut is backed with a steel plate. The micrometer adjustment cannot slip or fall when dies are adjusted.

All particulars in Perkins' new catalog; it shows over 200 styles and will interest all press users. Ask.



**Perkins Machine Co.,**

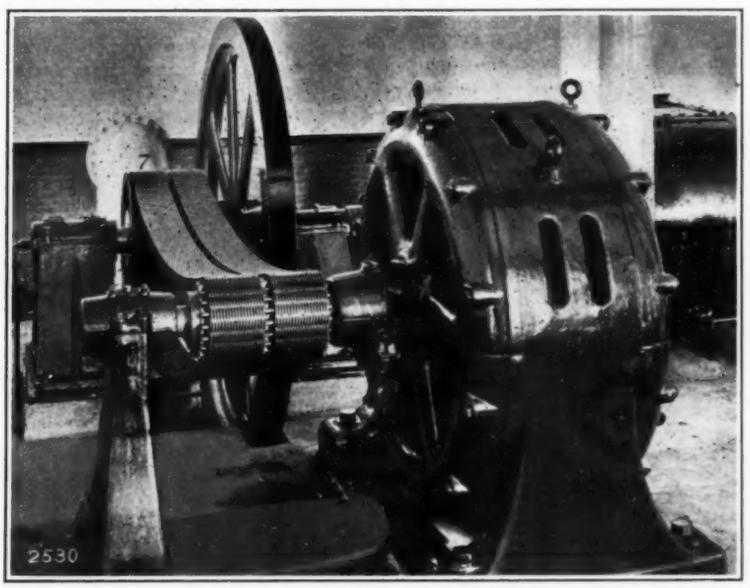
Main Office,
17 Perkins Street.

**Warren, Mass.**

**RENOLD SILENT CHAIN**

500 H.P. Drive, Operating Gas Blower.
Speed, 1900 Feet Per Minute.

Arlington Mills, Lawrence, Mass.




TWO strands of chain running parallel are employed in cases where one strand is insufficient to transmit the power.

The load is properly distributed between the chains, and the wear of the chains equalized, by the use of Spring Center Wheels on either driving or driven shafts.

New Booklet "F" tells why Silent Chain is the only non-elongating chain, the only chain which will run both ways, and the only chain employing spring compensating wheels. Write for it.

LINK-BELT ENGINEERING CO.,
PHILADELPHIA.
NEW YORK: 49 DEY STREET. PITTSBURG: PARK BUILDING.
LINK-BELT MACHINERY CO.,
CHICAGO.

# CRESSON

## Variable Speed Mechanism.

Possesses Mechanical Features which appeal to mechanics desiring a compact, durable and efficient variable speed device.

INCREASES OUTPUT BY ALWAYS ASSURING THE MAXIMUM CUTTING SPEED.

Can be applied as a countershaft for overhead drive, or as an intermediate factor between a motor and a machine tool to vary the cutting speed.

SELF COMPENSATING FOR WEAR OF PARTS.

**GEO. V. CRESSON CO.**

Power Transmitting Machinery,

141 Liberty Street,
NEW YORK.

Main Office and Works,
Allegheny Ave. W. of 17th St.
PHILADELPHIA.

*We make fuel gas plants too.*

# Get the Modern Gas Forge.

It does the work cleaner, better, cheaper and quicker than the old way. Here is the

## Gas Forge No. 2

which is designed for Lathe and Planer Tools, Short Drills, Taps and Reamers, or similar work.

It has an entrance 6 in. wide, by 3 in. high, with a depth of 6 in., and heats bars up to 2 in. sq. x 6 in. long.

The full description is in "High Speed Steel Supplement No. 2." Ask for it.

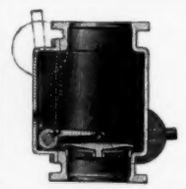
**American Gas Furnace Co.,**

**23 John Street, New York.**

Chas. Churchill & Co., London, Birmingham, Manchester and Glasgow. Schuchardt & Schutte, Berlin, Cologne, Vienna, St. Petersburg. H. Glaenzer & Perreaud, Paris.

# CRANE VALVES

ESTABLISHED 1855



**EXCELSIOR STRAIGHTWAY BACK PRESSURE VALVE**

is simple in construction and well made. Being fitted with the Jenkins Disc, it is noiseless and never sticks. Can be relied upon at all times when using exhaust steam for heating: or when used as a relief or free exhaust on a condensing plant. Working parts can be quickly thrown in and out of use without taking valve apart.

JENKINS BROS., NEW YORK, BOSTON, PHILADELPHIA, CHICAGO, LONDON.

# LUNKENHEIMER

Suitable for all movable bearings, works only while in motion, simple and practical in construction and easily filled without detaching plug. Glass sides show stage of oil. Attach cup so glass sides are parallel with rod. When cup is in motion the oil travels in a body within the cup, and at each revolution is thrown against the feed tube, flowing down through it to the bearing—the centrifugal force, combined with the shape of the body, carrying the oil to the holes in the feed tube. Specify *Lunkenheimer* and order from your dealer. Write for catalog.

THE LUNKENHEIMER COMPANY,
CINCINNATI, OHIO, U. S. A.

**"CHAMPION" ROD OIL CUP**

ORIGINATORS OF DISC GRINDERS

Free

we will grind without charge any unfinished sample you will send us reporting time and material used.

The Gardner Grinder

cuts fast because it can be run faster than a solid emery wheel. This speed is made possible thro' the use of steel discs to which emery cloth or paper is attached and these discs can be run at any speed without fear of explosion. The discs are spirally grooved which makes a clean shearing cut.

Interesting catalog is sent on request.

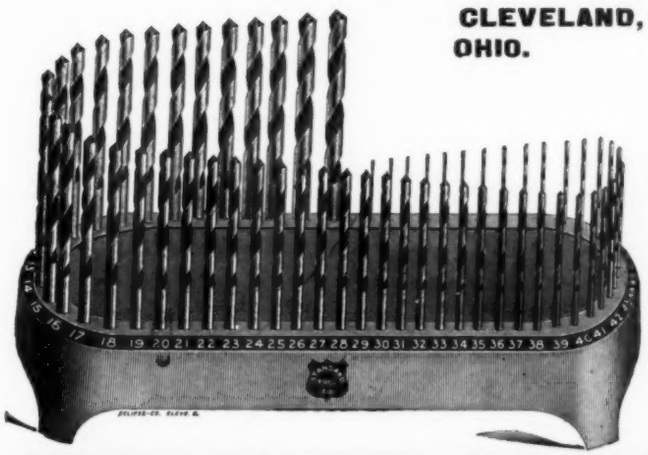
CHARLES H. BESLY & Co 15-17-19-21 CLINTON STREET CHICAGO ILL. U.S.A.

**The Standard Metal Drill Holder and Gauge Combined**

Manufactured Exclusively by

**THE STANDARD TOOL CO.,**

**CLEVELAND, OHIO.**



The Neatest and Most Convenient Drill Holder Made.

**New York Store: 94 Reade Street.**

Send for Descriptive Circular 5-8.

LONDON—C. W. Burton, Griffiths & Co. PARIS—Burton Fils, 68 Rue des Marais. GENEVA—J. Lambercier & Cie. MADRID—Carlos dal Re. BRUSSELS—Honore Demoor & Cie. MILAN—John M. Sumner & Co. RONSDORF—Carl Blombach. YOKOHAMA—F. W. Horne.

**The 16 In. "Ideal" Lathe Equipped With A Direct Connected Northern Motor**

The Springfield Machine Tool Co.

Springfield, Ohio, U.S.A.

gives a convenience of handling and quick change that increases the output nearly 100 per cent. over the old style belted cone pulleys. The operator has entire control of twenty speeds (ten ahead, ten reverse) right at his finger tips, by means of the lever on the left of apron. For particulars of the Friction Geared Head, the Quick Change Gear Device, etc., see catalog. You get a copy by asking.

Improved Oblique **Tumbling Barrel**

For wet or dry tumbling. Samples of parts in process of tumbling may be taken out during operation without stopping machine. Barrel can be adjusted to run in any desired position, thus rattling the parts more or less violently to suit the material from which they are made.

*Send for Tumbler Catalog.*

**The Globe Machine & Stamping Co.**
**970 Hamilton St., Cleveland, Ohio.**
English Agts: J. W. Jackman & Co., 39 Victoria St., London S. W., Eng.

**CALDWELL**
**Double Disc Friction Clutches**
**1½ to 1000 H. P.**

Compact, light weight, powerful, durable and adjustable to slip when a given load is exceeded.

*Send for Description.*

**H. W. CALDWELL & SON COMPANY**
**CHICAGO**
NEW YORK ATLANTA DALLAS

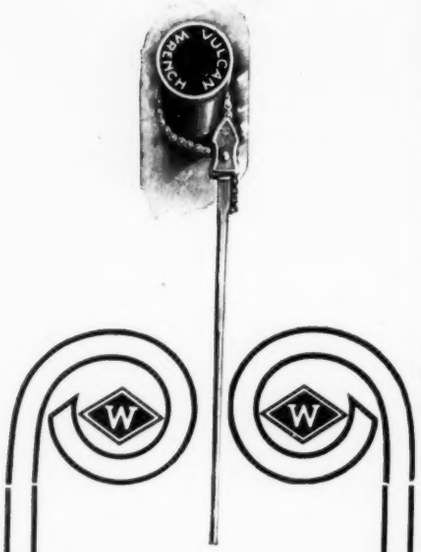
See our advertisements in June 16th and July 7th issues of the AMERICAN MACHINIST.

**The Waterbury Farrel Foundry & Machine Co.**
465 Bank St., Waterbury, Conn., U. S. A.
263-265 St. Clair St., Cleveland, Ohio.

**AIR COMPRESSORS**
SEND FOR COMPLETE CATALOG.
CLAYTON AIR COMPRESSOR WORKS,
114-118 LIBERTY STREET, NEW YORK.

**Shapers, Drilling Machines, Bolt Cutting and Nut Tapping Machines and Machinists' and Blacksmiths' Forges.**
For cuts and details see large ad in first and third issues of the month. Catalog will be sent on request.

**Boynton & Plummer,**
P. O. Box 27,
**Worcester, Mass., U. S. A.**




# Forget it

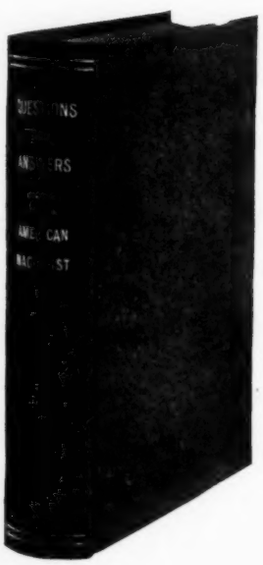
—as affecting pipe, we mean. Remember, however, that the "Vulcan" will turn a rusty bolt, a cold or heated shaft or anything cylindrical from ⅛ to 18 inches in diameter. Every shop has occasion for just such "Vulcan" usefulness. Every shop has need, too, for the best Pipe Wrench on earth—the "Vulcan," the father of double duty, double jaw, double chain tools. Again, every merchant-shop in this and foreign countries sells the "Vulcan."

**J. H. Williams & Co.,**
**Drop-forgings only,**
**Brooklyn, New York.**

Block 32, Machinery Building, St. Louis Exposition.

# A Wise Man Once Said

that education was not so much the acquisition of facts as it was the ability to find the facts when needed.




## Questions and Answers from the American Machinist

places 1088 facts where you can find them in an instant. They're facts that a man in your business wants.

The book contains 403 8x5½ pages, is well bound in green cloth, and costs $1.50.

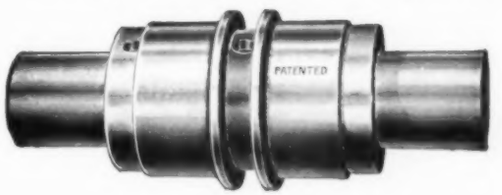
# Hill Publishing Comp'y

**World Building, New York.**

# THE JOHNSON FRICTION CLUTCH

## Single and Double with Hubs to Receive Pulleys, Cones, Gears, Etc.

High speed steel demands better and more powerful clutches on machines and countershafts. These clutches meet all requirements, and are being adopted by the leading machine builders. They are exceedingly powerful, operate easily and quietly, require but little space, and can be instantly adjusted by a single screw. Let us send you one on approval?




FOR CATALOGUE AND FURTHER INFORMATION, WRITE,

**THE CARLYLE JOHNSON MACHINE CO.** HARTFORD, CONN.

---

## Machine Shops

laid out with "Industrial" Railway. Cars for all purposes. Tracks, switches, etc., fitted together and laid down complete in our shops as they will be when installed.

Sole Manufacturers, **C. W. Hunt Company,**
West New Brighton, New York.

---

Jno. J. Cone. Robt. W. Hunt. Jas. C. Hallsted.
A. W. Fiero. D. W. McNaugher.

**ROBERT W. HUNT & CO.**
BUREAU OF INSPECTION
TESTS AND CONSULTATION
66 Broadway, New York. 1121 The Rookery, Chicago.
Monongahela Bank Building, Pittsburgh.
31 Norfolk House, London, England.
Inspection of Rails and Fastenings, Cars, Locomotives, Pipes, etc. Bridges, Buildings and other Structures.
Chemical and Physical Laboratories.
Reports and Estimates on Properties and Processes.

---

A. W. HARRIS OIL CO. HARRIS GAS ENGINE CYLINDER OIL PROVIDENCE, R.I.

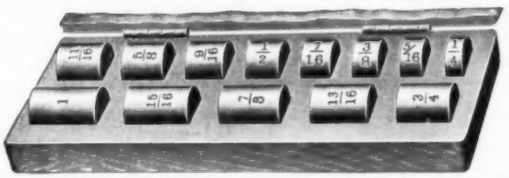
## A Gas Engine Cylinder Oil

which will perfectly lubricate at high temperatures, and will not carbonize or clog, is Harris Gas Engine Cylinder Oil.
Send for catalog.

**A. W. Harris Oil Company,**
321 So. Water St., Providence, R. I., U.S.A.

A. W. HARRIS OIL CO. HARRIS GAS ENGINE CYLINDER OIL PROVIDENCE, R.I.

---




## Standard Size Blocks.

Accurate, Indispensable. Economical, Efficient.

An article worth its weight in gold to any machinist. No up-to-date shop can afford to be without one or more sets. Not a luxury, but an article for every day use, at a price within reach of all. Send for circular A AT ONCE.

**MEISEL PRESS & MFG. CO.,**
944-948 Dorchester Ave., BOSTON.

---

LUBRIA F.P.&Co. N.Y. City TRADE MARK

## The Water Lubricant 98% Saving In Oil.

**LUBRIA, the Most Economical,** best lubricant for metal working, such as **Drilling, Turning, Boring, Cutting, Planing, Drawing, Stamping,** and all automatic machine work. For iron, steel, brass, copper, etc. No rust, no dirt, no gumming. Free from acids. The most perfect drilling compound ever made. A substitute for oil, soap water, etc.

**Sample Bottle on Request.**

**Foote, Pierson & Co.,**
82-84 Fulton Street, New York.

---

## PLANERS.

Frog and Switch Planers a specialty

**L. W. Pond Machine & Foundry Company,**
Worcester, Mass., U.S.A.

The Prentiss Tool & Supply Co. of New York City, Buffalo, Boston and Pittsburg. Marshall & Huschart Machinery Co. of Chicago and Cleveland.

---

**HENRY CARBY BAIRD & CO.,**
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS,
810 Walnut St., Philadelphia, Pa., U. S. A.

☞ *Our New and Revised Catalogue of Practical and Scientific Books, 92 pages, 8vo; a Catalogue of Books on Metallurgy, Mining, Prospecting, Mineralogy, Geology, Assaying, Analysis, etc.; a Catalogue of Books on Steam and the Steam Engine, Machinery, etc.; a Catalogue of Books on Sanitary Science, Gas Fitting, Plumbing, etc.; and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.*

---

## SECOND-HAND MACHINERY

**LATHES**

1—9 in. x 4 ft. x 6 in. Star Lathe, Countershaft and 6½ in. Chuck.
1—16 in. x 6 ft. Pratt & Whitney Engine Lathe, Taper Attachment.
1—20 in. x 8 ft. New Haven Engine Lathe.
1—24 in. x 10 ft. Lodge & Shipley Engine Lathe, 20 in. Chuck, Taper Attachment.
1—26 in. x 10 ft. Blaisdell Engine Lathe.
1—84 in. x 18 ft. Triple Geared Engine Lathe.
1—18 in. x 7 ft. Windsor Turret Lathe, 2 in. Hollow spindle.
1—14 in. x 6 ft. Warner & Swasey No. 3 Turret Lathe, 1 in. Hollow Spindle.

**MILLING MACHINES**

1—American Tool Works Hand Miller, with 4½ in. Vise.
1—Garvin & Co., No. 2 Plain Miller, with 6 in. Vise.
1—No. 1 American Tool & Machine Co., Valve Milling Machine.
1—No. 11 Brown & Sharpe Plain Milling Machine.

**DRILLS**

1—Foote, Burt & Co., Adjustable 2 Spindle Drill.
1—18 in. Burnham No. 4 Post Drill.
1—12 in. H. B. Tool Co. Sensitive Drill.
1—4 ft. 6 in. Universal Radial Drill Co. Radial Drill.

**BLOWERS**

1—No. 3 Monogram Blower, B. F. Sturtevant Co.
1—No. 5 Monogram Blower, B. F. Sturtevant Co.
1—No. 6 Monogram Blower, B. F. Sturtevant Co.
1—No. 7 Pressure Blower, B. F. Sturtevant Co.

**PLANERS**

1—36 in. x 36 in. x 10 ft. Sellers Planer, 1 head.
1—36 in. x 36 in. x 16 ft. Hewes & Phillips Planer, 2 heads.
1—60 in. x 60 in. x 14 ft. L. W. Pond Planer, 2 heads.

**BAIRD MACHINERY CO., PITTSBURG, PA.**

---

**The Largest Selection of Thoroughly High Grade Modern Second Hand Machine Tools—All Sizes for Every Duty.**

A few extra desirable bargains:

72" x 54' G. W. Davis & Co. triple geared Engine Lathe.
66" x 28' Farrel Fdy. & Mach. Co. triple geared Engine Lathe.
46' x 36' Fitchburg Machine Tool Co. triple geared Engine Lathe.
46" x 35' Fifield Tool Co. triple geared Engine Lathe.
39" x 16' Lowell Machine Co. triple geared Engine Lathe.
38" x 14' Fifield Tool Co. heavy Engine Lathe.
36" x 18' Lowell Machine Co. triple geared Engine Lathe.
27" x 10' Amer. T. Wks. heavy Engine Lathe.
24" x 24' H. G. Fish Mch. Tool Works heavy Engine Lathe.
60" x 60" x 18' G. W. Davis & Co. Planer, either one or two heads.
36" x 36" x 12' Flather Planer, two heads.
32" x 32" x 8' Pond Machine Tool Co. Planer, two heads.
62" Niles dbl. hd. Loc. Drv. Wheel Lathe, qr. attach.
20,000 Ferris & Miles Dbl. Fr. Stm. Hammer.
7,000 lb. Bement, Miles & Co. Dbl. Frame Stm. Hammer, with fine iron jib crane, 22' radius, 18' high.
88" Swing Betts Mch. Co. Radial Drill.
72" Swing American Tool Works Radial Drill.
42" Bement & Co. Car Wheel Boring Mill.
60" Swing Niles Tool Works Co. heavy stationary head Upright Drill Press (for railroad shop use).
16" x 12' Pond Mach. Co. Single Axle Lathe.
1,000 lb. Merrill Bros. Friction Board Drop Hammer.
2—19" Putnam Slotting Machines.
10" Niles Tool Works Slotting Machine.
No. D4 Ferracute Mch. Co. Double Acting Drawing Press, weight 5,500 lbs.
2" x 24" Jones & Lamson Flat Turret Lathe.

☞ FRANK TOOMEY, 127-131 N. Third St., Philadelphia.

---

BIGNALL & KEELER MFG. CO.
EDWARDSVILLE, ILL.
IMPROVED MACHINERY FOR CUTTING AND THREADING PIPE
For Hand or Belt Power
With Steam Engine or Electric Motor Attached

---

# CRANE FITTINGS

ESTABLISHED 1855

## Special Low Prices To Reduce Big Stock

# 2nd-Hand

## Crowded for Room

BORING AND TURNING MILL, 37 in., 1 head.
" " " " 60 " 2 heads.
" " " " 72 " 2 heads.
UPRIGHT PULLEY BORER, 50 in., "Niles."
COLUMN FACING LATHE, Double head, 72 in. swing, 27 ft. between, wt. 90,000 lbs., modern style.
HYDRAULIC WHEEL PRESS, 84 in., 200 tons, "Bement."
DRIVING WHEEL LATHE, 62 in., Double head.
PULLEY LATHE, 50 in., 2 tools, "Niles."
AUTO. THREADING LATHE, 16 in. x 8 ft., Latest.
LATHE, 64 in. x 18 ft., Triple geared, complete.
" 50 " x 14 " Pond, blocked from 38 in.
" 50 " x 20 " Triple geared, latest pattern.
" 42 " x 16 " " " modern, heavy.
" 36 " x 18 " " " latest pattern.
" 33 " x 16 " Back geared, latest pattern.
" 26 " x 9 " "Bogert," with taper.
" 21 " x 10 " "Reed."
" 18 " x 6 " "Barker," Taper attachment.
" 16 " x 6 " "Reed," "Prentice," "Flather."
PLANER, 64 " x 10 " "Bement," 1 head.
" 54 " x 10 " "Putnam," 1 head.
" 42 " x 10 " "Powell," 2 heads.
" 36 " x 10 " "Fitchburg," 3 heads.
" 32 " x 14 " "Whitcomb," 2 heads.
" 30 " x 12 " "Fitchburg," 1 head.
" 26 " x 6 " "Sellers," "Gray."
" 24 " x 6 " "Bement."
" 20 " x 4 " "Pond."
SHAPER, 20 " Stroke, Crank, "Gould & Eberhardt."
" 15 " Friction geared, "Hendey."
RADIAL DRILLS, 76 in. and 96 in. "Gang," "Prentice."
UPRIGHT DRILLS, 20 in., 21 in., 23 in., "Prentice."
UNIVERSAL MILLING MACHINE, "Kempsmith," latest, back-gears, automatic feeds.
UNIV. GRINDING MACHINE, No. 2, capacity, 12 in. x 40 in., "Brown & Sharpe."
COMB. ENG. & TURRET LATHE, 18 in. x 7 ft., 2 in. hole, friction head, carriage and turret feeds.
SCREW MACHINE, wire feed, 27-32 in. "Bardons."
COLD SAW, 4½ in., latest construction
AUTO. GEAR CUTTER, 18 in. spur, "B. & S."
PLAIN " " 30 " " & bevel, "Whiton."
STEAM HAMMER, 400 lbs., "Morgan."
BOILER TOOLS { Punch, 36 in., weight 18,000 lbs., new. Rolls, 10 ft., hinged housing, new. Riveter, 96 in., hydraulic.

## J. J. McCabe,

**14 Dey St., New York.**



**Second-Hand Machine Tools in Good Condition.**
Low Prices.

**Planers.**
20 in. x 4 ft. Pease | 24 in. x 6 ft. Pease
30 in. x 6 ft. Whitcomb

**Shapers.**
14 in. Steptoe | 15 in. Gould.
16 in. Gould & Eberhardt B. G.

**Lathes.**
22 in.x 22 ft. Prentice(Fish) | 21 in. x 18 ft. Fitchburg
30 in. x 12 ft. Draper D.B.G. | 18 in. x 8 ft. Dexter C. R.
16 in.x8 ft. Am. change gear | 18 in. x 6 ft. American C.
14 in. x 6 ft. Blaisdell | 15in.x5ft.Mansfield,St'd&B.

**Grinders**
Diamond Mach. Co. Wet Grinder
Gisholt Universal Tool Grinder
Bath Universal Tool Grinder

**Upright Drills.**
20 in. Sibley & Ware | 28 in. Blaisdell,sliding head
34 in. Blaisdell,sliding head

**Milling Machines.**
Garvin, and Pratt & Whitney, Hand
Oesterlein No. 20 Universal, B. G.

**Power Presses.**
No. 12 Bliss | No. 3 Coulter & McKenzie
No. 1 Coulter & McKenzie Sprue Cutter
150 lb. Stiles Friction Drop

**Speed Lathes.**
14 in. x 5 ft. Whitcomb | 16 in. x 6 ft. Blount
24 in. x 10 ft. Harrington

**Miscellaneous.**
Adt Riveter, 3-16 in. | Garvin Screw Slotter
8 in. Cox Pipe Machine | No. 0 Newton Cold Saw, 12 blades

**The Fairbanks Company,**
New York. Philadelphia. Boston. Buffalo.
New Orleans. Pittsburgh.



**The BATES MACHINE CO.,**
**346 Broadway, New York.**

**Numbering Machines for Numbering Metal Parts.**
**Machine-Engraved Wheels and Type for Registering Devices.**



# Second-Hand Tools

**Lathes.**
No. 3 Bench Lathe, Pratt & W.
No. 5 Bench Lathe, Sloane & C.
13 in. x 6 ft. R. & F. Ames
14 in. x 6 ft. C.R. Prentice Bros.
15 in. x 6 ft. Plain, Pratt & W.
16 in. x 6 ft. R. & F. Blaisdell
16 in. x 6 ft. R. & F. Fifield
16 in. x 8 ft. Pratt & W.
18 in. x 6 ft. R. & F. Lodge & D.
18 in. x 8 ft. R. & F. Pratt & W.
19 in. x 7 ft. Pl. Swiv. Pratt & W.
19 in. x 12 ft. Pratt & W.
20 in. x 9 ft. Pratt & W.
22 in. x 8 ft. Plain, Niles
29 in. x 14 ft. Fitchburg.
26 in. x 12 ft. C. R. Fitchburg.
42 in. x 18 ft. C. R. & T. Niles T. W.
26 in. Pulley Lathe
42 in. Pulley Lathe
14 in. Chucking Lathe
16 in. Chucking Lathe
18 in. Chucking Lathe
26 in. Chucking Lathe
35 ft. Pit Lathe
20 ft. Pit Lathe
Bement Axle Lathe
Milwaukee Turret Lathe

**Planers.**
16 in. x 16 in. x 3 ft. Pratt & W.
16 in. x 16 in. x 3 ft. Lathe-Morse
26 in. x 26 in. x 6 ft. Flather
26 in. x 26 in. x 8 ft. New Haven
30 in. x 80 in. x 8 ft. Fitchburg
38 in. x 42 in. x 14 ft., 4 heads, Pond
48 in. x 48 in. x 18 ft., 2 heads, Niles
62 in. x 60 in. x 18 ft., 2 heads, Bement
78 in. x 72 in. x 24 in., 3 heads Bement

**Shapers.**
9 in. Traverse head, Sellers.
10 in. Shaper, Gould & Eberhardt.
15 inch Lodge & Davis
24 inch Smith & Mills
24 inch Steptoe

**Screw Machines.**
No. 1 Garvin
No. 2 Pratt & W.
No. 12 Garvin
No. 3 Pratt & W.
No. 4 Wilson, Wheeler & Co.
No. 3 Garvin
No. 1 Auto. Pratt & W.

**Drills.**
13 in. Bench Drill, Prentice
12 in. Sensitive, Herrick & Co.
18 in. Sensitive, LeBlond
20 in. Prentice.
2-Sp. Bicycle Rim Drill, Fox
11 in. 3 Sp. Sigourney
14 in. 3-Sp. Hendey
10 in. 3-Sp. Adj., Foote, B. & Co.
17 in. 4-Sp. Pratt & W.
17 in. 4- Sp. Jones & Lamson
21 in. Cincinnati
24 in. Cincinnati, with tap. att.
24 in. Blaisdell, sliding head
4 in. Putnam
5 ft. Radial, Pond
6 ft. 10 in. No. 2 Radial, Niles
10 in. 3-Sp. Adj. Foote B. & Co.
17 in. 4-Sp. Pratt & W.
17 in. 4-Sp. Jones & Lamson.
16 in. 6-Sp. Quint
16-Sp. Car Wheel Drill, Niles
Hoefer Horizontal Drill

**Milling Machines.**
Bench Hand Miller
No. 1 Garvin Hand Miller
No. 3 Garvin Hand Miller
No. 1 Plain, Pratt & W
No. 2 Plain, Garvin
No. 3 Plain, LeBlond
Ames Hand Miller
Brainard Index Miller
No. 1 Brown & Sharpe Universal
No. 2 Plain, Kempsmith
No. 4 Vertical, Pratt & W.
No. 3 H. Vertical, Becker-B.
Garvin Profiler
30 in. Gear Cutter, Whiton
No. 6 Vertical, Niles.

**Boring Machines.**
Horizontal Boring Head, Nicholson & W.
No. 3-B, 5 ft. table, Binsse
No. 2, 6 ft. table, Bement
28 in. x 12 ft. Horizontal, Sellers
No. 1, Loco. Cyl., Newton
50 in. x 18 ft. Horizontal, Sellers
60 in. x 12 ft. Horizontal, Pond
50 in. Pulley Borer, Niles
14 ft. Borer & Turning Mill, Niles

**Grinding Machines.**
Centre Grinder, Heald
No. 1 Tool Grinder, Brown & S.
Walker Cutter & Reamer Grinder
7 in. x 15 in. Univ. Grinder Brown & Sharpe
8 in. x 16 in. Univ. Grinder, Diamond
16 in. x 66 in. No. 4-A Univ. Grinder, Landis
12 in. x 2 in. Wet Tool Grinder, Blount
24 in. x 42 in. Wet Tool Grinder, Barnes

**Miscellaneous.**
No. 18 Bliss Inclined Press
No. 51 Ferracute Press
No. 4 Stiles Punch
Hydraulic Riveter and Crane, 1 in. cap. rivets, pressure 35 gross tons, cap 8 ft.
No. 1 Newton Cold Saw
¼ in. Shuster Riveter

**Send for New Second-Hand List,**

**Niles-Bement-Pond Co.,** 138 Liberty St. NEW YORK.



# Hilles & Jones Tools in Stock

SINGLE PUNCHES OR SHEARS.
54" throat, 1¾" hole in 1⅛" plate.
50" throat, 1¼" hole in 1" plate, arch'l jaw.
42" throat, 1" hole in 1" plate.
36" throat, 1¼" hole in 1" plate.
30" throat, 2¼" hole in 1⅜" plate, arch'l jaw.
12" throat, ¾" hole in ½" plate.

SPLITTING SHEARS.
For ¾" plate, 6 x 1 flats, 2" rounds.
For 5-16" plate, 4 x ⅜ flats, 1¼" rounds.

PLATE SHEAR.
86" bet. hsgs., 36" throat, cap'y ¾" plate.

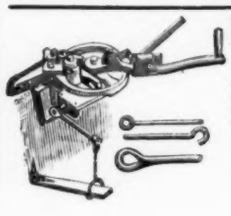
SECOND-HAND TOOLS.
Heavy Double Punch and Shear, 30" throats, weight 27 tons.

## Hilles & Jones Company,

Manufacturers of machinery for working plates, bars and structural shapes,

**Wilmington, Delaware.**





## EYE BENDERS.

We make *hand* power benders for forming eyes from stock 1⅜ inch thick and under. Any size eye 7 inches outside diameter and under.

**Wallace Supply Co.**
56 Fifth Ave., CHICAGO, ILL.



# BARGAINS

**A Few Choice Pieces of Machinery From Our Second-Hand List.**

BORING MACHINES.
No. 1 Beaman & Smith floor boring machine, used one year.
Beaman & Smith duplex boring machine for pump work.
No. 2 Barrett cylinder boring machine, 5" bar.
2½" bar Binsse horizontal boring machine.
3" bar Bement horizontal boring machine.
8' Bement vertical boring mill, two heads.
42" Niles car wheel borer, power crane and power hub facing attach.
42" Bement car wheel borer, hand crane and hub facer.

LATHES.
30" x 19' Fifield, C. R. & P. C. F., & chuck.
26" x 20' Pond shafting lathe.
24" x 12' Fifield, C. R. & P. C. F.
22" x 12' Blaisdell, C. R. & P. C. F.
18" x 8' Flather, C. R., 1½" H. S.
17" x 6' Bradford, plain, G. R.
16" x 7' Reed, C. R. & P. C. F.
15" x 6' Blaisdell, R. & F. R.
12" x 5' Hendey-Norton toolroom, short legs and pan.

PLANERS.
54" x 54" x 16' Wm. Sellers, 4 heads.
52" x 36" x 8' Cinn., 2 heads, good as new.
30" x 30" x 10' Powell, 1 head, all parts.
27" x 27" x 8' Ohio Mach. Co., 2 heads.
17" x 17" x 4' Whitcomb, suitable for toolroom.
3—16" crank planers.

MILLING MACHINES.
No. 5 Brown & Sharpe, plain rack feed.
3 No. 12 B. & S. plain Manufacturers.
No. 0 American Tool Works, plain.
No. 2 Owen universal, all attach.
4-spindle Cook vertical miller.
P. & W. semi-automatic cutter.

SHAPERS.
30" Cin., triple geared, ext. base.
18" Putnam, friction.
15" Hendey, friction.
4 traveling head shapers, 8, 10 and 12" strokes.

DRILLS.
4' arm Bausch plain radial.
5' arm Bickford plain radial, motor drive.
3½' Keystone plain radial.
2—28" Barnes uprights, with friction pulleys for tapping.
6-spindle Hendey gang.
6-spindle mult. drill, cap. 1" holes.

GRINDERS.
No. 2 Brown & Sharpe universal.
No. 2 Landis universal.
No. 3 B. & S. cutter and tool.
Gisholt grinder.

SCREW MACHINES.
2—1¼" Cleveland automatics.
1—2" do.
No. 2½ P. & W., wire feed.
Pearson forming and drilling machine, 2¼" W. F. cap.

MISCELLANEOUS.
Vogel crank turning machine.
½" Adt straightening and cut-off machine.
⅜" and ¼" Adt riveters.
2-spindle Whiton centering machine.
No. 1 Davis keyseater.
1-spindle Garvin profiler.
2-spindle P. & W. profiler.
16" Bement crank slotter.
12" Betts crank slotter, heavy pattern.
9" Niles slotter, practically new.
Send for complete list of new and second-hand machinery in stock.

## Prentiss Tool & Supply Co.

**115 Liberty Street, N. Y. City.**

507 D. S. Morgan Bldg., Buffalo, N. Y.
145 Oliver St., Boston, Mass.

A few of the best

# Machine Tools

**On our second hand list.**

1—Blaisdell lathe, 19" x 10'.
1—Lodge-Davis lathe, 21" x 9', with taper attachment.
1—Oakland lathe, 21" x 10'.
1—Flather lathe, 21" x 10', new, but old style.
1—Wheeler planer, 22 x 22 x 5'.
1—Whitcomb planer, 24 x 24 x 6'.
1—Whitcomb planer, 30 x 30 x 10'.
1—Putnam planer, 36 x 36 x 12.
1—New Haven planer, 40 x 36 x 13, with two heads.
1—No. 0 turret brass lathe, 26" swing, made by American Tool & Machine Co., in fine condition, a great bargain.
1—No. 1 Brainard milling machine, large, heavy machine, table 50" long, in excellent condition.
1—No. 23 Brown & Sharpe milling machine, table feed 48", a bargain.

Also a large stock of Lincoln milling machines, shapers, upright drills, etc. Write for what you want. We may have it.

**HILL, CLARKE & CO.,**

**Main Office,**
**156 Oliver St., Boston.**
**Chicago Office,**
**14 South Canal Street.**
**New York Office,**
**153 Greenwich (cor. Liberty) Street.**

# Choice Bargains

DRILL PRESSES.

3-spindle Drill, D'Armour & L.
No. 3 4-spindle Drill, Garvin.
16" adjustable 3-spindle Drill, Foote-Burt.
22" Hoefer Drill, back geared, power feed.
36" Hamilton Drill, back geared, power feed, as new.

LATHES.

9" Brown & S. Universal Bench Lathe and collets.
No. 10 Star Engine Lathe, foot power.
12 x 4 Engine Lathe, foot power.
12 x 4 Blaisdell Engine Lathe, rise and fall.
14 x 5 Putnam Engine Lathe, rise and fall and chuck.
16 x 6 Fifield Engine Lathe, rise and fall.
16 x 6 Blaisdell Engine Lathe, rise and fall and taper att.
17 x 7 Putnam Engine Lathe, rise and fall.
18 x 6 Fuller & W. Engine Lathe, rise & fall.
18 x 8 New Haven Engine Lathe, plain rest.
32 x 14 Hamilton Engine Lathe, triple geared, new.

PLANERS AND SHAPERS.

16 x 16 x 4 Hendey Planer.
24 x 24 x 6 Flather Planer, new.
15" Hendey Shaper.
20" Springfield Shaper, new.

MISCELLANEOUS.

No. 3 Garvin Hand Milling Machine.
No. 21 Garvin Plain Milling Machine.
No. 4 Potter & Johnston Chucking Lathe.
Brown & Sharpe Chucking Lathe.
20 x 7 Davis Chucking Lathe.
No. 2 Pratt & W. Screw Machine, wire feed.
No. 20 Hibbard Punch Press.
No. 00 Mossberg Foot Press.
No. 3A Mossberg Double Acting Press.
No. 3 Garvin Universal Cutter Grinder.

*Write us your wants.*

**The**
**Garvin Machine Co.**
**Spring and Varick Sts.**
**NEW YORK**

# SECOND-HAND MACHINERY

**FOR PROMPT SHIPMENT.**

ENGINES.

12 x 30 Lane & Bodley Corliss, L. H.
16 x 32 Buckeye, R. H., automatic.
9 x 12 Erie Ball, C. C., automatic.
14 x 36 Harris-Corliss.
14 x 20 R. H. Side Crank, slide valve.
8 x 9 L. H. Self-Contained.
12 x 12 Phoenix, center crank, auto.

GAS ENGINES.

25 H.-P. Gasoline, with fr. clutch.
5 H.-P. Gasoline, pulley 12 x 8.
2 H.-P. National Gasoline.
6 H.-P. Acme Gas.

PUMPS.

Worthington Ver. Duplex, double act., suction 6", discharge 4", with motor.
No. 15 4 x 6 Rumsey Hand Fire Pump.
14 x 7 x 12 Knowles Regular, duplex.
2¾ x 1½ x 4 Hall Auto., with rec.
No. 2½ Blake, single acting, with boiler.
3½ x 2¼ x 4 Snider-Hughes, duplex.

AIR COMPRESSORS.

9" Steam Cyl. Blowing Engine.
8" Steam Cyl. Blowing Engine, Hughes.
2¼ x 6 Clayton, vert., belt driven.
Vert. Belted Double Stage, high pressure.

HEATERS.

No. 2 Monitor Heater & Purifier, 30-60 H.-P.
250 H.-P. Closed Heater.

DYNAMOS.

King Plating, with rheostat.
360-375 light, No. 319, 110 volts.
600-16 C. P. Light Alternating Generator.
175-16 C. P. Bipolar, with rheostat.

BLOWERS AND FANS.

No. 6 Root's Hor. for cupola.
No. 1 Root's Hor. for cupola.
60" Sturtevant Steam Fan.
No. 5 Sturtevant Steel Pressure.
No. 4 Sturtevant Steel Pressure.
No. 5 Buffalo Monogram, 40".
No. 11 64" Buffalo Dbl. Belted Pressure.
34" Smith Ventilating Fan.
36" Motor Driven Ventilating Fan.

GRINDERS.

200 Single and Double End Emery Grinders, mounted on column.
24 x 2" Wet Tool Grinder, W. F. & J. Barnes.
Double Water Tool Grinder, 24 x 1½".

SANDING MACHINES.

24" Two-Drum Sander.
13" Double Disk Sand-Papering Machine.

PLANERS AND MATCHERS.

No. 2 Double Cyl. Planer with beading att.
26" Single Cyl. Endless Bed Planer.
30" J. A. Fay Imp. Smoothing Planer.

MISCELLANY WOOD-WORKING.

No. 3 H. B. Smith Tenoner, single head.
Horizontal Boring Machine.
No. 2 Smith Power Mortiser and Borer.
Double Spindle Wood Shaper, iron frame.
Self-Feed Rip Saw, Edinburg.

MISCELLANY.

Electrotyper's Circular Metal Saw, iron frame, iron table, Wesel make.
Lot of assorted sizes of Countershafts, Pulleys, Hangers, Belting and Shafting.

**C. C. Wormer Machinery Co.**
**57-63 Woodbridge St., West,**
**DETROIT, MICH.**

**For Sale—Lathe,** 2" x 24" Jones and Lamson triple geared flat top turret complete tool equipment, except opening die and taper. Guaranteed in excellent working order. Used 2½ years, cost, $1,135.00. Sell for $650.00, f.o.b., Reading, Pa.

**J. W. Cregar Agency,**
**Bourse Bldg., Philadelphia, Pa.**

**UNIVERSAL JOINTS**

**BRONZE** In stock or **STEEL** made to order.

**BOSTON GEAR WORKS, Boston, Mass.**
Send for Catalog R3.

**ARE YOU REPRESENTED IN NEW ENGLAND?**

If you wish to be, I have opened a Selling Agency for New England, and arranged to represent a number of good machine tools, but am open to take up three or four more.
Will be glad to correspond with any manufacturer who desires representation in an up-to-date manner in this territory.

**W. H. BAUSH, 310 Whitney Building, Springfield, Mass.**

**JEFFREY** ELEVATING, CONVEYING, POWER TRANSMISSION **MACHINERY** FOR CATALOGUE, ADDRESS THE JEFFREY MFG. CO. COLUMBUS, O.

# SUPERIOR SECOND-HAND MACHINERY.

LATHES.

7' Face-plate Lathe.
60" Niles Pulley Lathe.
50" x 22' Fitchburg, triple grd., shop worn.
39" x 14' Fifield, triple grd. forge lathe.
36" x 16' Fitchburg triple grd., shop worn.
32" x 14' Pond, fine condition.
30" x 20' Sellers, triple geared.
28" x 14' Lodge & Barker, compound rest.
26" x 18' Le Blond, shop worn.
24" x 10' Niles, with taper att. and chuck.
23" x 14' Le Blond, shop worn.
20" x 12' Reed, with compound rest.
18" x 8' Lodge & Shipley, turret on shears.
16" x 8' Reed, with taper.
20—14" Lathes, different makes.

GISHOLT LATHES.

28" Gisholt Turret Lathe.
20" Gisholt Turret Lathe.

PLANERS.

60" x 48" x 16' Gleason.
54" x 54" x 12' C. H. W. Co., two heads.
42" x 36" x 15' New Haven.
36" x 36" x 10' Pond, two heads, shop worn.
30" x 30" x 8' Cincinnati, shop worn.
26" x 26" x 8' Davis & Egan.
24" x 24" x 6' Davis & Egan.
24" x 24" x 6' Cincinnati.
24" x 24" x 5' Gray.
16" x 16" x 42" Hendey.
14" Crank Planer.

SHAPERS.

16" Gould & Eberhardt.
20" Steptoe.
26" Morton.

RADIAL DRILLS.

American Tool Works, 5' arm.
Amer. Tool Works, 5' arm, semi-universal.
No. 2 Bickford, new pattern, shop worn.

BORING MILLS.

10' Niles, double head.
80" Sellers.
42" Bullard, turret head.
40" Brown & Sharpe, turret head.
36" Bullard, double head.
32" Newton Wheel Boring Machine.

HORIZONTAL CYLINDER BORING MACHINES.

Binsse "C," 6' table, shop worn.
2—⅞" Bar, 8' table, Bement.
6—½" Bar, Niles.

MILLING MACHINES.

48" Niles Slab Milling Machine.
20" x 20" x 8' Ingersoll.
No. 4 Brown & Sharpe, plain.
No. 3 Cincinnati, universal.
No. 2 Cincinnati, universal, positive feed.
No. 5 Garvin, large table.
15—No. 0, No. 1 and No. 2 Millers, different makes.

AUTOMATIC SCREW MACHINES.

2—Brown & Sharpe, ⅝".
2—Hartford, ½".
1—Spencer, ⅝".
3—Cleveland, 2".

HAMMERS.

100 lb. American, post.
600 lb. American.
3,500 lb. Bement, double frame.
40 lb. Bradley, helve.
300 lb. Pratt & Whitney, drop.
800 lb. Pratt & Whitney, drop.

PUNCHES AND SHEARS.

12" throat for 1" work.
18" throat for 1" work.
Double End Punch and Shear, ¾" work.
Hand Punch and Shear for I-beams.

MISCELLANEOUS.

Oil Separator.
12 H.-P. Gas Engine.
25" Pneumatic Riveter.
Gould & Eberhardt Sand Sifter.
No. 3 Oliver Wood Trimmer.
Sellers Twist Drill Grinder.
No. 2 Landis Grinder.
Rivett Bench Lathe.
Brown & Sharpe Gas Furnace.
8" Bement Slotter.
Excelsior Swaging Machine.
Knowles Draw Stroke Slotter.

Send for complete list. Photographs furnished on application.

**Marshall & Huschart Machinery Co.**
**62-64 S. Canal St., Chicago, Ill.**
**24 Lake St., Cleveland, O.**

## FOR SALE

1 2,000 lb new Pittsburg Shear Knife & Machine Company Double Stand Steam Hammer. Will sell for $1,450.00. Guaranteed in every respect.

**Heppenstall Forge & Knife Company**
**PITTSBURG, PA.**

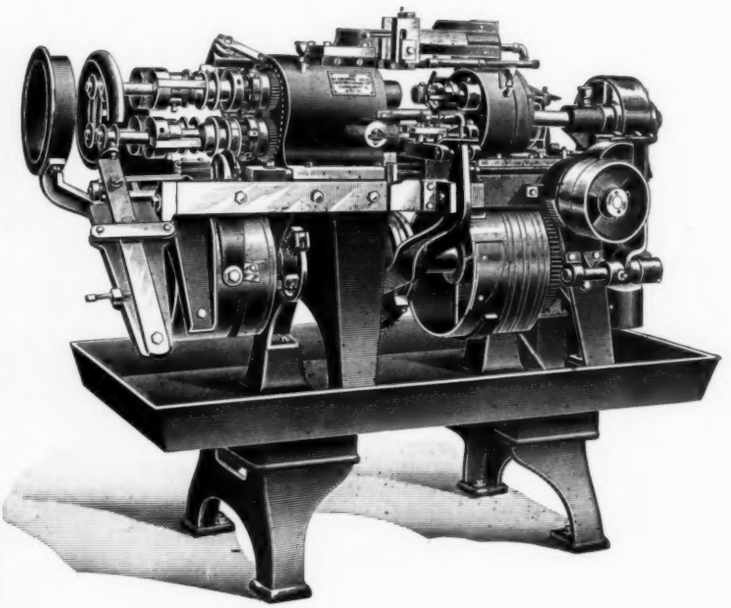
# TO THE THOUGHTFUL AND PROGRESSIVE MECHANICS, MACHINE SHOP MANAGERS OR OWNERS WHEN AT THE FAIR

**Inspect the "Acme Automatics"**

in operation at Block 7, Aisle 1-D, Machinery Building, and judge for yourselves regarding our claims as to closest ACCURACY together with maximum PRODUCTION. Particular attention is invited to the steel product which is being

**Lettered Back of a Shoulder.**

No equally severe public test as to accuracy has heretofore been made on any automatic screw machine that we are aware of. For the speedy production of a neat brass thumb nut see also our small machine.



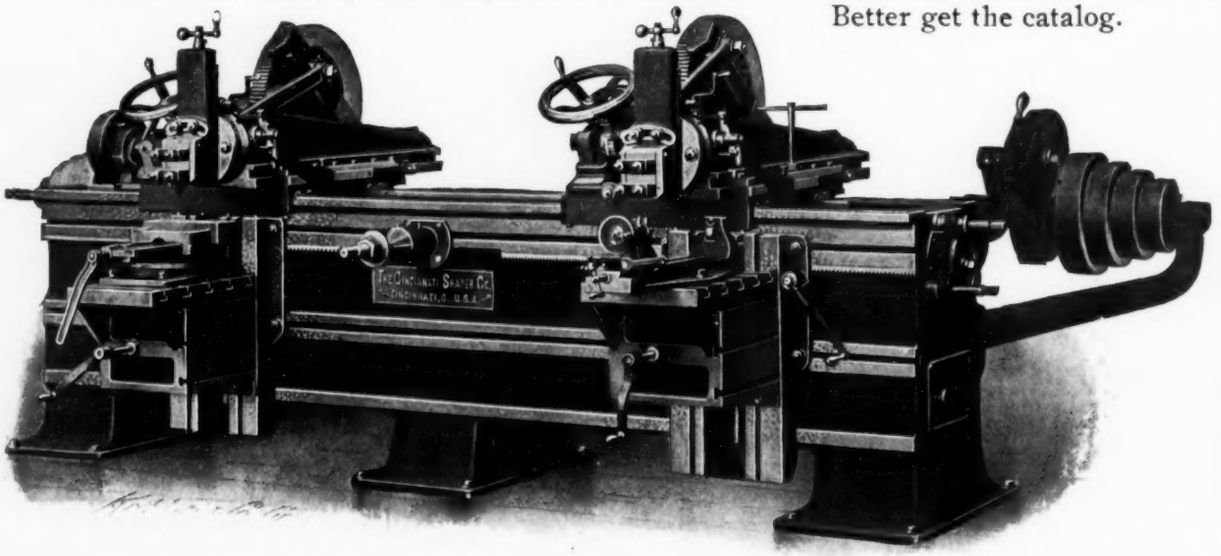
**We Carry A Complete Stock Of SET and CAP Screws .·. Specials Made To Order**

## THE NATIONAL ACME MFG. CO., Cleveland, Ohio, U.S.A.

Schuchardt & Schutte, General Foreign Representatives. Branch Offices: New York, Boston, Chicago, Philadelphia.

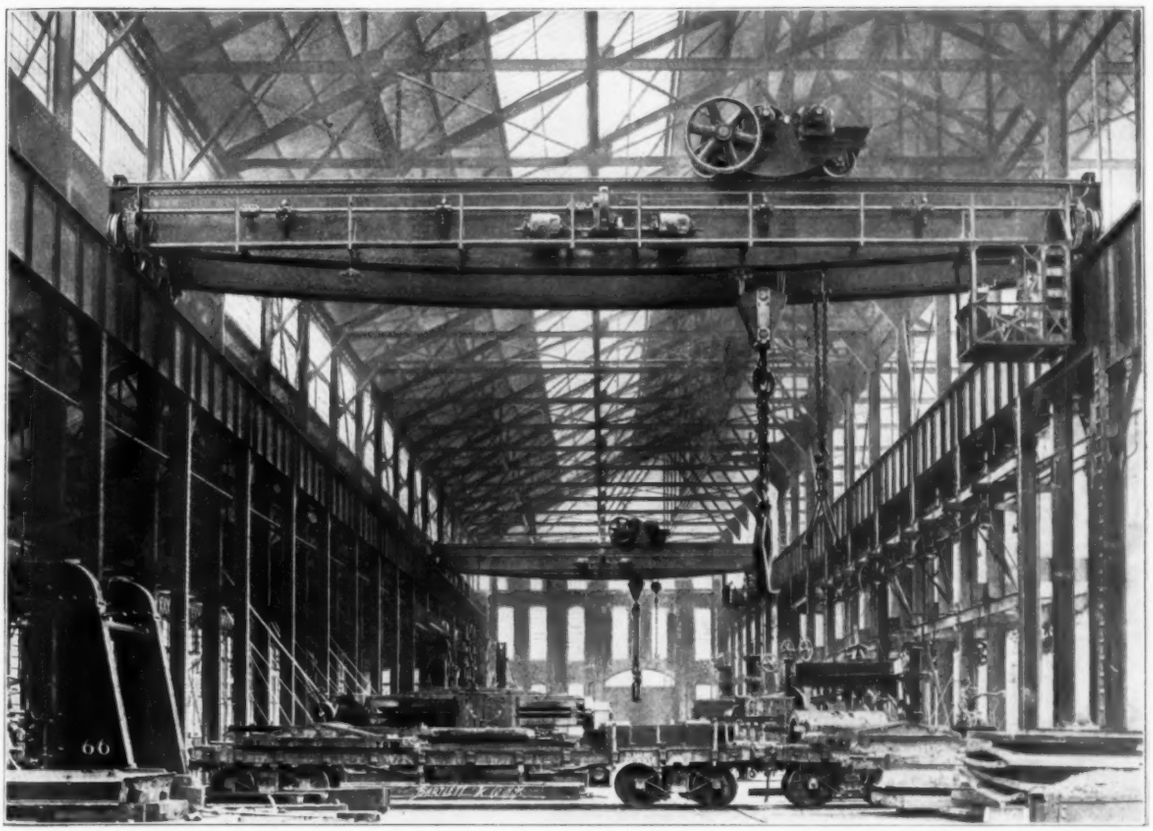
# The "Cincinnati" Shaper is a Permanent Profit Producer.

It's accurate and speedy, simple in construction and operation, and always efficient. Better get the catalog.

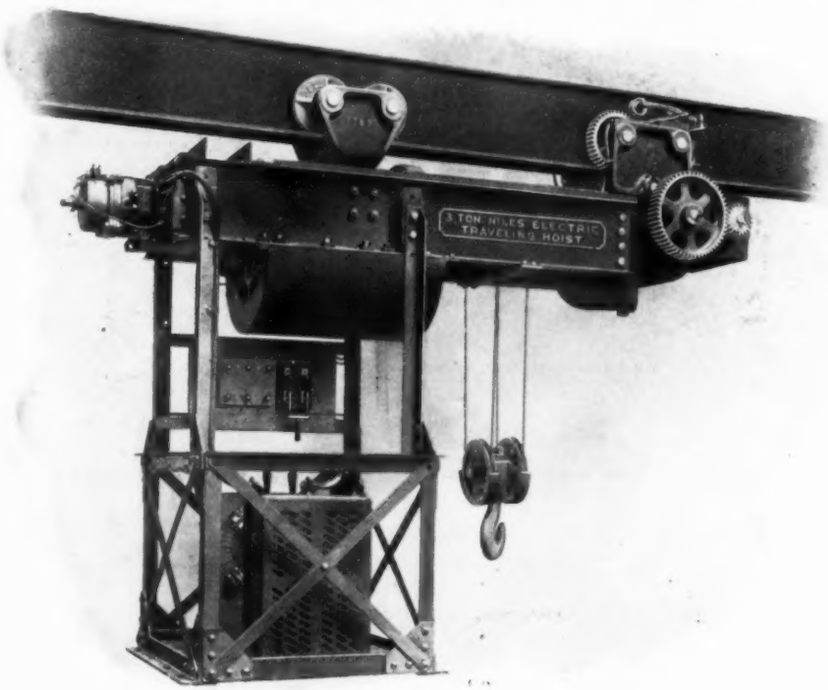



## The Cincinnati Shaper Company,

**Elam Street and Garrard Avenue, Cincinnati, Ohio, U. S. A.**



Two 75 Ton NILES CRANES, 60′ Span, with 20 Ton Auxiliary Hoists, Carnegie Steel Co, Homestead, Pa.




# NILES ELECTRIC TRAVELING CRANES and HOISTS.

## NILES-BEMENT-POND CO.,

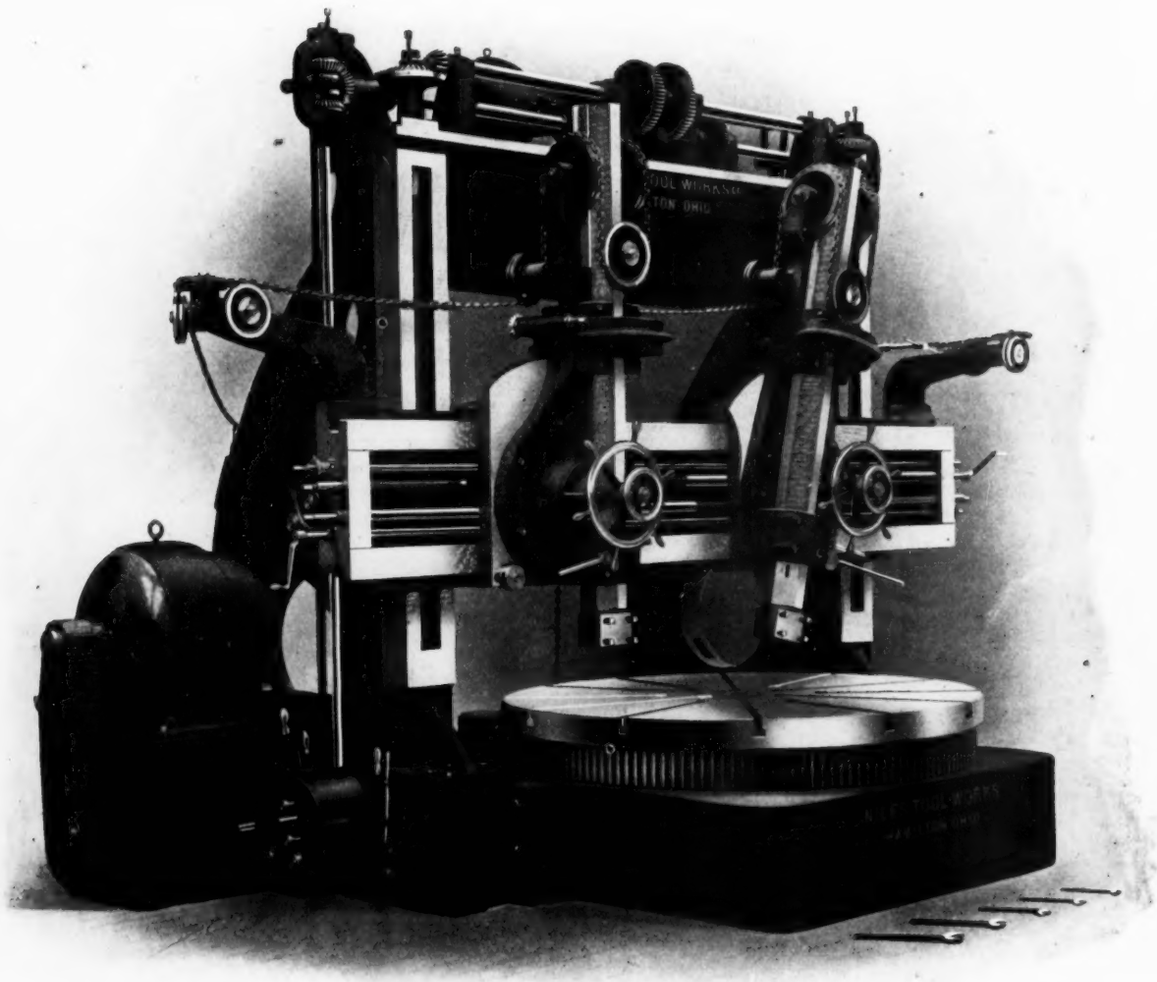
### 136-138 LIBERTY STREET, NEW YORK, U.S.A.

OFFICES:

Boston: 144 Pearl St. Chicago: Western Union Bldg. Pittsburgh: Frick Bldg.
St. Louis: 516 North 3d St. Philadelphia: 21st and Callowhill Sts. AGENTS: The Fairbanks Co., 749 Craig St., Montreal, P. Q.

# NILES BORING MILLS

**Nested gear feeds to bars independent in rate and direction.**



10166 A

**New 10 foot Boring and Turning Mill for use with modern high power tool steels.**

Niles Boring and Turning Mills are built in twenty-five sizes from 30 inch to 30 foot swing.

---

# NILES-BEMENT-POND CO.,

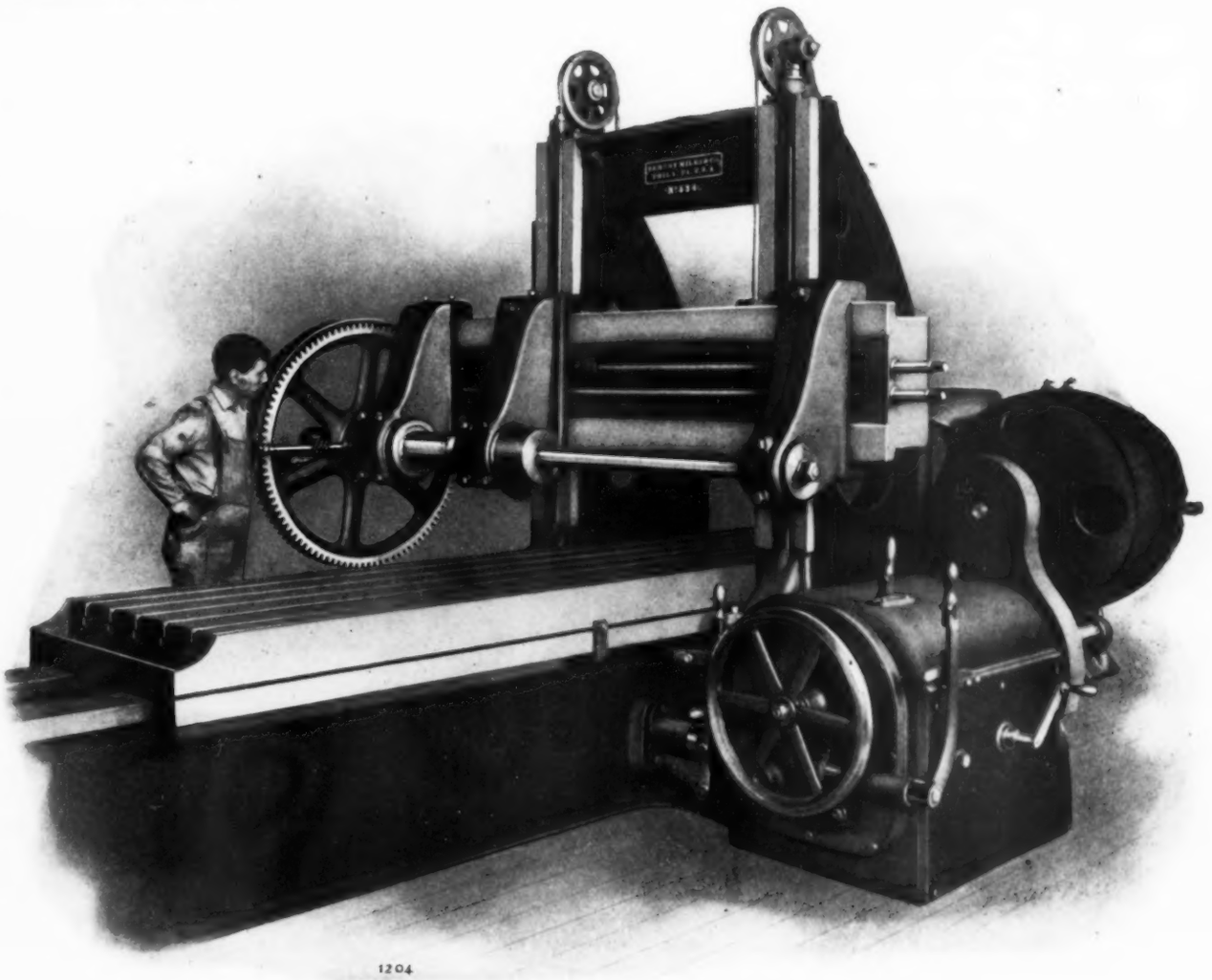
**136-138 LIBERTY STREET, NEW YORK, U.S.A.**

OFFICES:

Boston: 144 Pearl St. Chicago: Western Union Bldg. Pittsburgh: Frick Bldg.
St. Louis: 516 North 3d St. Philadelphia: 21st and Callowhill Sts. AGENTS: The Fairbanks Co., 749 Craig St., Montreal, P. Q.

# MILLING MACHINES:

**Plain and Universal Millers, Die Sinkers, Profilers, Vertical and Horizontal Cotter Drilling and Keyseating Machines, Thread Millers, Gear Cutters, Horizontal and Vertical Millers, Circular Millers, Etc.**



1204

**Bement No. 6 Horizontal Milling Machine.**

Our standard type shown above has counterweighted cross-rail, and is so arranged that the bearing for the outer end of the mandrel may be traversed entirely free of the mandrel, allowing the easy insertion of different mandrels. Feeds are positively driven by gearing, and are variable throughout a wide range. Cutters up to 16 inches in diameter may be used.

## Niles-Bement-Pond Co.,

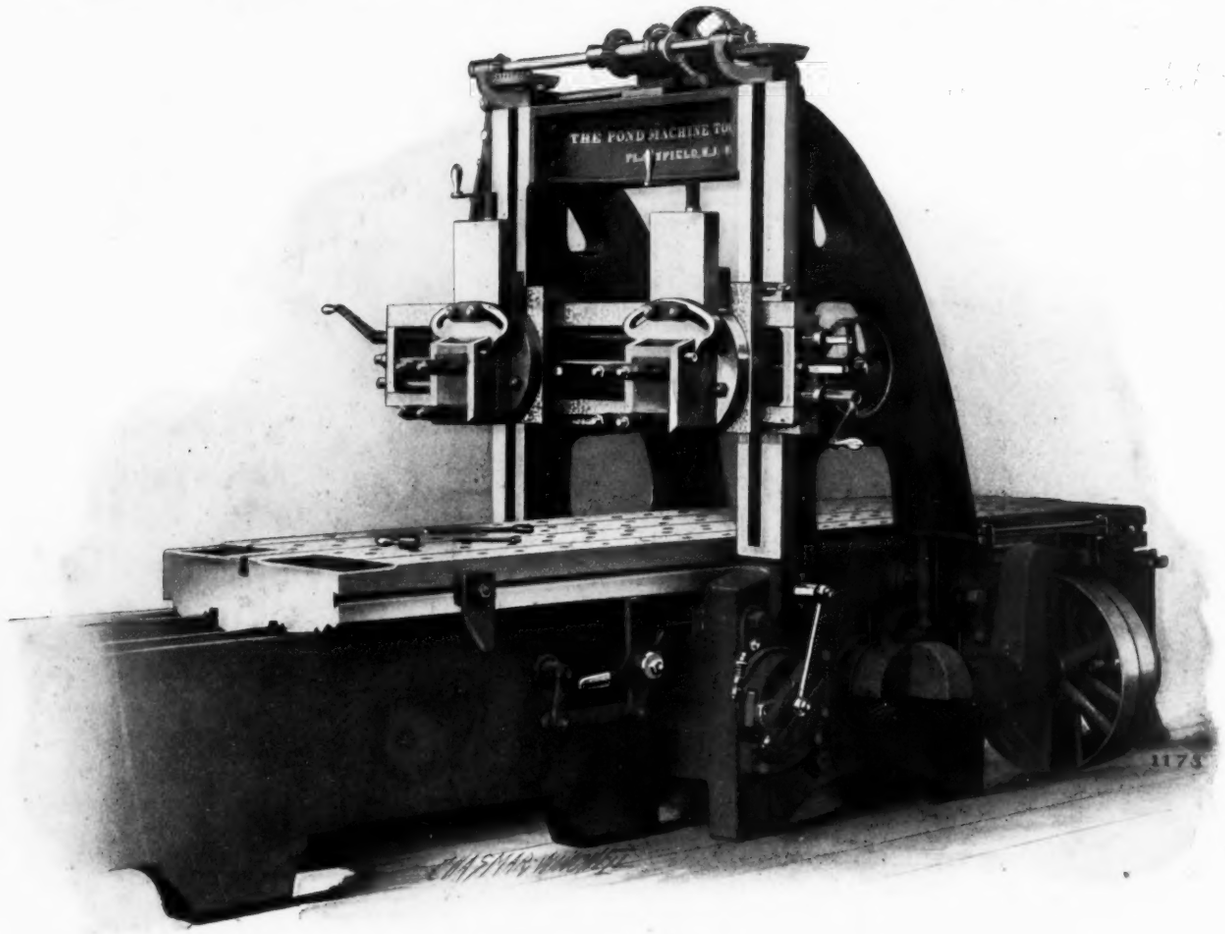
**136-138 Liberty Street, New York, U.S.A.**

OFFICES:

Boston: 144 Pearl St. Chicago: Western Union Bldg. Pittsburgh: Frick Bldg.
St. Louis: 516 North 3d St. Philadelphia: 21st and Callowhill Sts. AGENTS: The Fairbanks Co., 749 Craig St., Montreal, P. Q.

# POND PLANERS

## Regularly built in stock sizes from 30 to 84 inch.




**36-Inch Standard Planing Machine—Parallel Drive.**

Two general types of Standard Planers are built; planers in which the table is driven by a train of spur gearing, and planers in which the table is driven by tangent gearing. Both types may be built to stand either parallel or at right angles to the line shaft.

We build a great variety of sizes of planers from 17 inch to 12 feet, embracing the following types:

**Standard Planers, Crank Planers, Extra Heavy Planers, Frog and Switch Planers, Vertical and Horizontal Planers and Rotary Planers.**

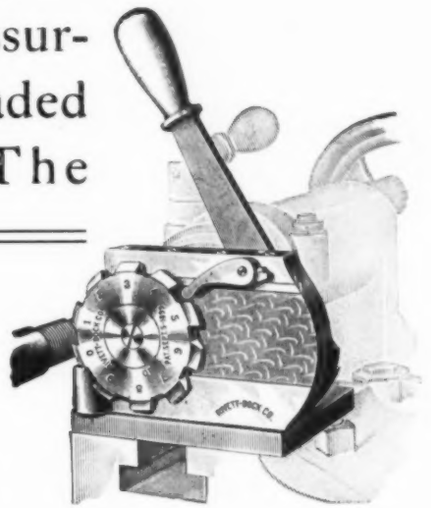
## Niles-Bement-Pond Co.,

**136-138 Liberty Street, New York, U.S.A.**

OFFICES:

Boston: 144 Pearl St. Chicago: Western Union Bldg. Pittsburgh: Frick Bldg.
St. Louis: 516 North 3d St. Philadelphia: 21st and Callowhill Sts. AGENTS: The Fairbanks Co., 749 Craig St., Montreal, P. Q.

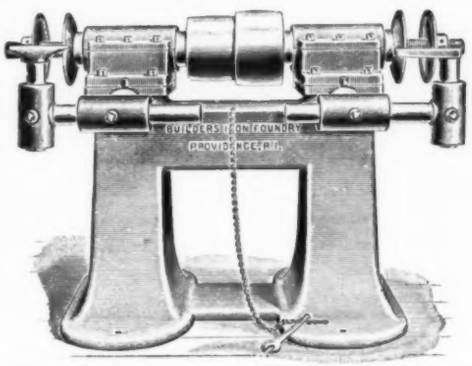
## For The Safeguarding and Assurance Of Profit On Your Threaded Work You Should Use The Rivett-Dock Thread Tool



because it will not only do better work than any single pointed tool but will do the work in from ⅓ to ⅛ of the time taken by the single pointed and where it might be necessary to sharpen the Rivett-Dock tool once it would be necessary to sharpen the single pointed at least a hundred times. This tool comes to you on approval, for say, 30 days. Keep it if you think it's what we say 'tis; send it back if 'tisn't. Book?

Send for Catalog fully describing **Rivett-Dock Company** Brighton Boston, Mass., U. S. A.

Send for Catalog of Precision Machinery **Faneuil Watch Tool Co.** Brighton Boston, Mass., U. S. A.



## HEAVY FLOOR GRINDER.

*40 in. between wheels.*
*Takes wheels 36 in. diameter, 5 in. face.*
*Weight, about 1,400 pounds.*

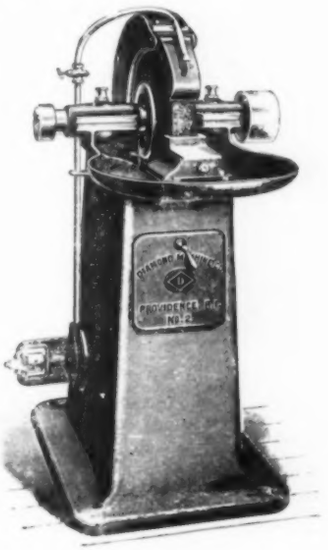
TRADE MARK

**Builders Iron Foundry,**
PROVIDENCE, R. I., U.S.A.

## WATER TOOL GRINDERS.

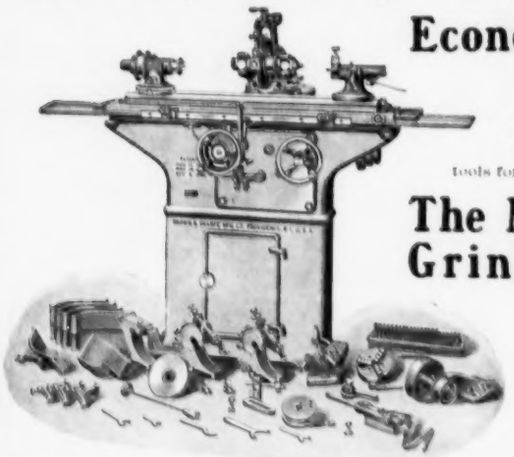
*We make five sizes of these machines with wheels 14x2, 20x2½, 24x3½, 30x4, 36x4 in. They are all supplied with countershaft, settling tanks, permanent truing device, and a thoroughly satisfactory pump.*

*We have sold several thousand Water Tool Grinders, some large concerns having as many as thirty of them.*



**Diamond Machine Company,**
PROVIDENCE, R. I., U.S.A.

**Brown & Sharpe Mfg. Co.** Providence, R.I., U.S.A.



**Economical Manufacturing**

demands careful consideration in the selection of machines and tools for the equipment of the Tool Room.

**The No. 1 Universal Grinding Machine**

is well adapted for Tool Room Work.

Catalogue and circulars mailed on application.

**See Page 55**

Everything is right about the

**HAMMERS**

built at this shop, even to the "hang" of the handles. Ball, Straight and Cross Pein Hammers. Sold with handles on'y.

**The Billings & Spencer Co.**

HARTFORD, CONN., U. S. A.

Drop Forgings of Every Description.

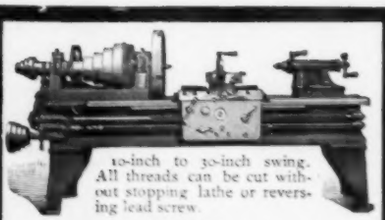
**Black Diamond Files and Rasps**

PERFECT ALWAYS

Twelve Medals Awarded at International Expositions

For Sale Everywhere

**G. & H. BARNETT CO., - Phila., Pa.**



10-inch to 30-inch swing. All threads can be cut without stopping lathe or reversing lead screw.

THE

**R. K. LeBLOND MACHINE TOOL CO.**

4020 EASTERN AVENUE,
CINCINNATI, OHIO., U.S.A.

Niles Tool Works Co., New York, Eastern Agents.

J. Lamberder & Co., Geneva, Sole Agts. for Switzerland.

**Opinions Differ,** but there is one that prevails. **Use Our Tools** and you will say as the other fellows do,

Drills, Reamers, Taps, Cutters, Mills, Etc.

TRADE MARK

**They are the Best.**

Sold by all principal dealers, or write to us.

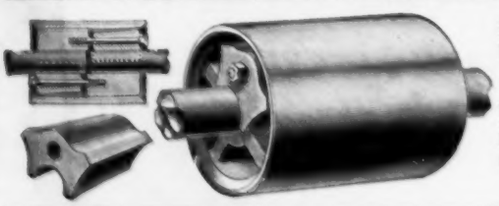
**CLEVELAND TWIST DRILL CO.**

CLEVELAND. NEW YORK. CHICAGO.

ARE YOU LOOKING

forward to laboring in a hot, uncomfortable office this summer? No better remedy than BUFFALO DISK WHEELS. They keep the air cool in all overheated apartments.
Electric - Steam - Pulley Types.

Buffalo Forge Co.,
Buffalo, N. Y.



Stuart's Patent **Compression** Wedge Coupling

Requiring No Keys

Has successfully stood the test for eleven years, and is still being shipped on trial or money returned if you want it. All sizes kept in stock.

R. J. Stuart's Foundry & Machine Works,
NEW NAMBURG, N. Y.

**GLEASON GEARS**

CUT OR PLANED

ROCHESTER, N.Y.

**Bristol's Recording Instruments.**

For Pressure, Temperature and Electricity.

*Makes Continuous Records Day and Night. Send for Catalog.*

Silver Medal Paris Exposition

The Bristol Co., Waterbury, Ct.

New York Branch, 113 Liberty St.

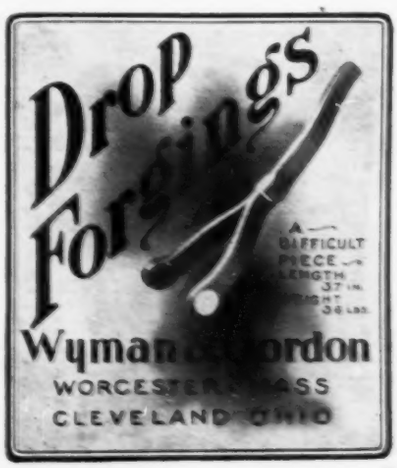
**RAWHIDE GEARS**

MANUFACTURED BY

The Horsburgh & Scott Co.

Cleveland, Ohio

**IF THESE HACK SAWS**

were not good Hack Saws and filled every Hack Saw want they would not be used by so many people.

**WEST HAVEN MFG. CO., New Haven, Conn.**